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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE
AMERICAN MACHINIST PUBLISHING CO.,
256 BROADWAY, NEW YORK.

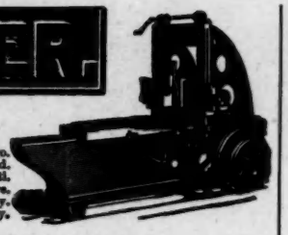
Some Leading Articles in this Number.

Box Tools for Common Lathe.
A Compound Yacht Engine.
A Large Surfacing Machine.
Graduations on Taper Attachments.
Building a Great Dynamo.
Arbor Practice.
The Microscope as a Center Indicator.
A Swedish Tool Grinder.
Productive and Non-Productive Labor.
The Danger of 2,000 Pounds Air Pressure.

NINETEENTH YEAR.

No. 30.
July 23,
1896.

THE GRAY PLANER.



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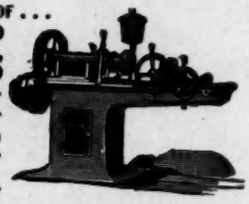

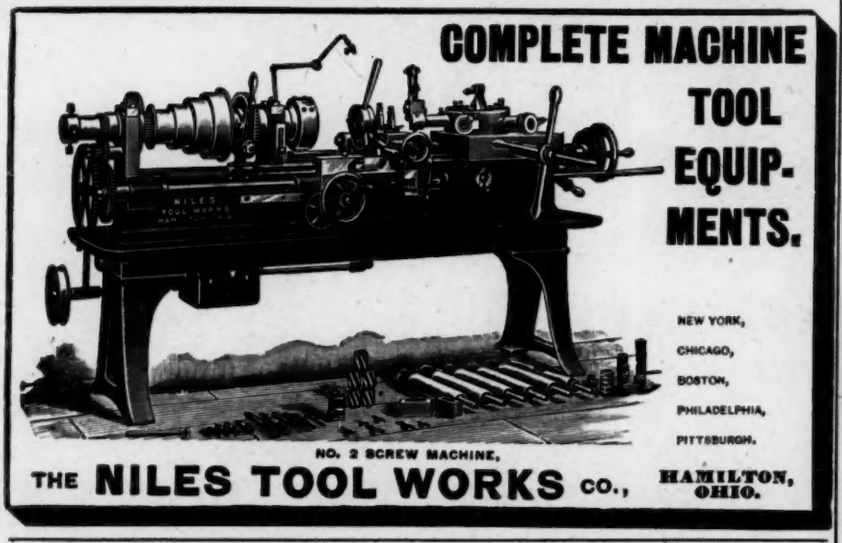

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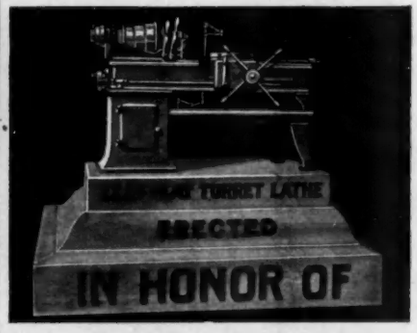

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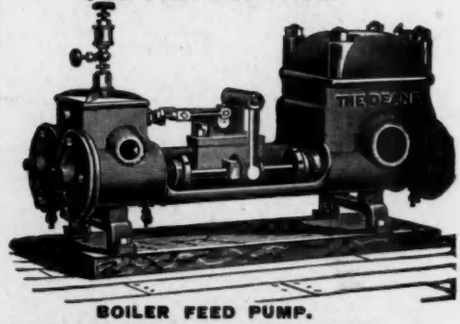

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AMERICAN MACHINIST

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NEW YORK, THURSDAY, JULY 23, 1896.

VOLUME 19. ▲ ▲ ▲ NUMBER 30.

Box Tools for Common Lathe.

BY C. O. GRIFFIN.

There is no class of work which gives more satisfaction to the true mechanic than the construction of rigs whereby an everyday tool is made to do the work of a special tool.

A device of this kind, which is of frequent application, is what I call a "lathe-box tool"—the name being derived from the fact that the tool has a slight resemblance to a regular turret-lathe box tool. The sketches which follow show the tool as applied to two pieces of work which would usually be considered to be turret-lathe jobs.

Fig. 1 is a very simple case; but simple as it is, it is a hustler in getting out work, and illustrates a method which is not used as often as it might be. The work to be done is the turning of a ring of about 3-inches outside diameter, 2½ inches inside diameter, and ¾-inch thickness. These rings have to be made in considerable quantities. The outside diameter and the thickness are required to be uniform within narrow limits; but the inside diameter, while machined, is not required to be maintained so exactly uniform. The boring and facing were done in a turret lathe, the rings being caught in a bell chuck. This bell chuck was of such size and depth as to provide plenty of room, and the facing of both sides of the ring was done at once through the hole by two tools carried in one holder—thereby securing the desired uniformity of thickness. The diameter of the set screws of the chuck being less than the thickness of the ring, the tools could pass right over the work without fear of damage to anything.

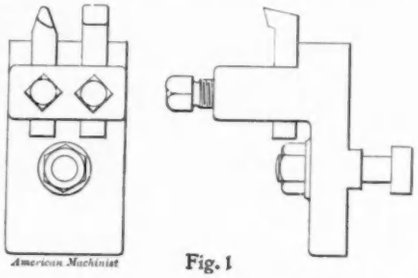
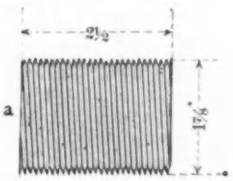


Fig. 1

For the turning, the rings were caught on a special mandrel between a fixed and a screw collar, in order to insure the turning being square with the facing, and then the turning was done by the fixture shown in Fig. 1.

It consists simply of a small angle casting fitted and bolted to the tool block of the lathe—the tool post being removed. This casting has two holes through it with suitable set screws at the top. The left-hand hole carries the roughing tool, and the right-hand hole the finishing tool—the distance between the tools being a little more than the width of the ring to be turned. The finishing tool projects beyond the roughing tool by the depth of the finishing chip. In operation, the first ring is turned with the calipers, as usual; but after the finishing tool has made its cut, the lathe is stopped and the work taken out. Without disturbing the cross-feed, the carriage is cranked back and a new piece of work is put in the lathe. The tools are now in correct position to turn the ring to size without trial cuts, calipering or loss of time changing tools. The tools are simply fed across the work, when it is taken out the carriage is cranked back and a new piece is put in, and the operation is thus repeated indefinitely.

In the present case the lathe used had that tiresome arrangement by which the feed gears must be changed and adjusted to mesh in order to change the feed. Consequently, we utilized the screw-cutting gear for the finishing feed—the rod feed being used for roughing only. As soon as the roughing tool had done its work, the rod feed was thrown out and the screw feed thrown in. By having two mandrels—one to be filled while the other is in the lathe—one of the rings can be kept in the air most of the time.



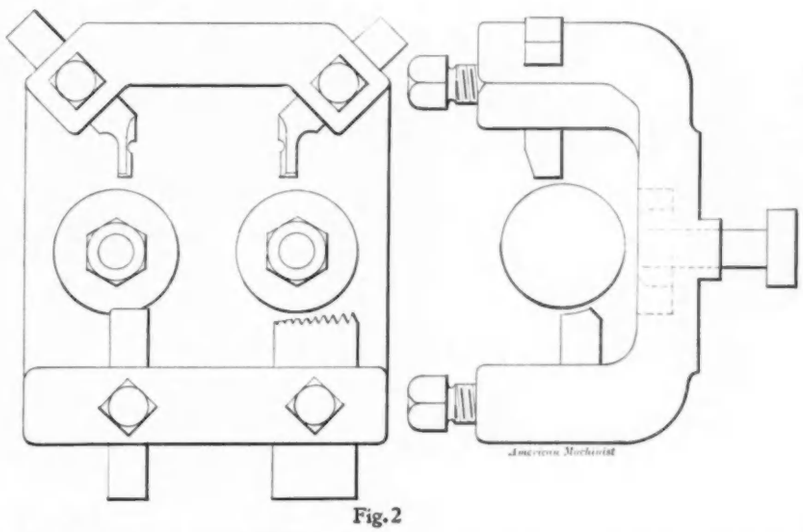


Fig. 2

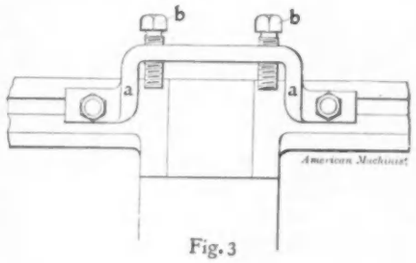


Fig. 3

Fig. 2 shows a more elaborate arrangement, intended to produce the piece shown at *a*, which is a brass bush required to be threaded all over on the outside and to be faced at both ends—uniformity being required in both the threads and the length over all.

The box tool casting is in this case U-shaped, and carries two facing tools bottom side up at the back side. These tools are of a distance apart to give the required length to the piece; and being bent and put through the holder at an angle, this distance can be easily maintained after grinding. The front leg of the "U" carries the turning and chasing tools—their distance apart being slightly more than the length of the piece of work—the chasing tool projecting beyond the turning tool slightly more than its depth of cut. In this case the cross-feed cannot be left undisturbed for the threading of the next piece on account of the facing of that piece, and stops are required to bring the cross-feed repeatedly to the same point for the different pieces. These stops are shown in Fig. 3, in which *a a* is a twisted and bent piece of flat iron bolted to the back side of the lathe carriage. Two set screws *b b* project through it, one for the turning and the other for the chasing tool. A suitable distance piece is laid between one or the other set screw and the end of the tool block, according as turning or chasing is to be done, and, of course, defines positively the size of the work. Of course, one set screw could be made to answer by carefully setting the turning and chasing tools to agree with each other, but separate stops save this and are much more satisfactory—a fact which the turret lathe builders are beginning to learn.

For doing this work we selected a lathe such that the lead of the thread to be cut was an exact multiple of that of the lead screw. Both rod and screw feeds run continuously, and the lathe is never stopped except to change the work—the feed required being thrown in as wanted, and the carriage being cranked back with the lathe in motion, as the chaser is bound to follow the thread it has previously started.

The pieces shown are made of hard phosphor bronze and in lots of from fifty to a hundred. The time consumed varies from six to eight minutes per piece in different lots, this time being the total elapsed time divided by the number of pieces made, the elapsed time including all "get ready" operations with subsequent grinding and setting of tools—in other words, everything chargeable to the job. One lot of parts of common brass was turned out in three minutes each.

This rig was devised because our turret lathe had no screw-cutting attachment, and dies did not seem to be a promising method of doing the work. I doubt very much, however, if the time given could be improved upon in a full-fledged brass lathe—especially with the hard material used—for which the chasing bar of a brass lathe would be springy and uncertain compared with the slide rest of an engine lathe.

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Motor Vehicles in England.

BY W. H. BOOTH.

So far we have considered chiefly the difficulties connected with motor vehicles. We may now turn to the other side and see how they are to be overcome.

Let us first consider the guiding. This, as I have said, has been somewhat difficult, especially on rough roads. The reason is that the ordinary lock gear—like a locomotive leading truck—has been used. This requires a deal of strength to hold it steady. Any opposition to one wheel tends to cause the frame to slew around and deviate the car from its path suddenly and without warning. In the newer vehicles there is no frame of the swiveling description, but each of the two leading wheels is independent and fixed directly to the car framing and not to a swiveling frame. Each wheel is capable of swiveling about its own vertical diameter, or nearly so. It cannot therefore be displaced by an obstruction, and the guiding of a vehicle is effected by means of a very small lever, and the danger of sudden lateral departure of the carriage is abolished. I have already pointed out the abolition of liquid acid in the accumulator cells of electric carriages, and shown that they are thus rendered fairly safe in case of an accident. With petroleum carriages for ordinary climates, the oil employed is of a specific gravity of about 700 and has a flashing point not less than 70 degrees centigrade; but it is found then that the evaporation of the light oil as it is carried off by the air which vaporizes it, causes such refrigeration that some warmth must actually be imparted to the liquid in order to make it vaporize sufficiently. This action of refrigeration is important in that it will maintain the oil at a low temperature, and thereby prevent danger. One naturally turns to the electrical motor as the absolutely perfect motor as regards balance of moving parts and ease of reversal, but the cell difficulty makes the petroleum motor a more practical and commercial machine. Everywhere in France one can buy the "petrole" to run an oil motor vehicle, and the French have done a good deal to develop the oil carriage in the way of simplifying the guiding and providing for safety and for diminishing the quantity of cooling water required, so as to lessen the weight to be carried, and they have made easily reversible machines and added numerous simple safety appliances; so that in France one looks on the oil carriage as an accomplished fact, and some of them run without perceptible vibration and are altogether fairly presentable vehicles—much more presentable, in fact, than the Parisian belles, who go about in their knickerbocker cycling suits as perky as parrots and anything but graceful in appearance.

I am told that, as regards charging up the cells of an electric car, the time required is two hours. Unless, therefore, in future arrangements are made throughout the country to enable empty cells to be exchanged for full ones, this charging-up is likely to prove a serious difficulty with electric cars, and will add to the value of the oil vehicles, especially as these are already in common use except in England, where the law is being altered at last to enable them to be employed.

But our old and trusty friend, steam, is still alive. In the form of the Serpollet engine, steam is being very much used for load vehicles. I saw numerous tramcars in Paris a week ago, running with Serpollet motors. The steam-raising portion is peculiar. There is a tubular boiler, the tubes being in section a sort of flattened smicircle, the water passage being only about $\frac{1}{16}$ inch wide. Water is forced into the tubes in small quantities at a time, and at once becomes steam. To stop the engine you simply shut off the feed, and the steam contents being practically nil, the engine stops almost at once. For tramway work and for heavy cars or parcel vans, the Serpollet motor seems to be all right and is very highly rated by one of the prominent men in motor vehicles; but for light vehicles I cannot see that it is so very suitable, because of the trouble of carrying fuel and water, of firing up, and so on; nor do I see how the choking of the narrow tubes with the deposit from calcareous water will be conveniently dealt with by the users. It may be all very well to deal with deposits by chemical solvent where there are numbers of vehicles and a staff of mechanics; but for the private owner, who has a motor carriage because he cannot be troubled with, or cannot afford, a horse, this will be a difficulty, and the petroleum carriage alone seems to-day to be the one for ordinary use. It is not so powerful as a steam car, nor can it so easily be started; it has not the absolute balance of the electric car; but it is a fair all-around compromise, and has, I believe, come to stay.

As regards expense, less than 25 pounds weight of oil will run a four-seat carriage about 5 hours, or, say, 50 to 60 miles on a fair road. In England the oil does not cost 2 cents a pound, and it ought to be less in America.

In regard to construction, it is clear that there is a good deal of difference between a horse-drawn vehicle and one self-propelled. The leading wheels must be made stronger, because they are now pushed into holes rather than lifted out of them, and are thus much more strained. The rear wheels have ceased to be simply supports to a vehicle; the power to propel the vehicle now passes through them. In all vehicles that I have yet seen, the driving wheels are driven by means of a

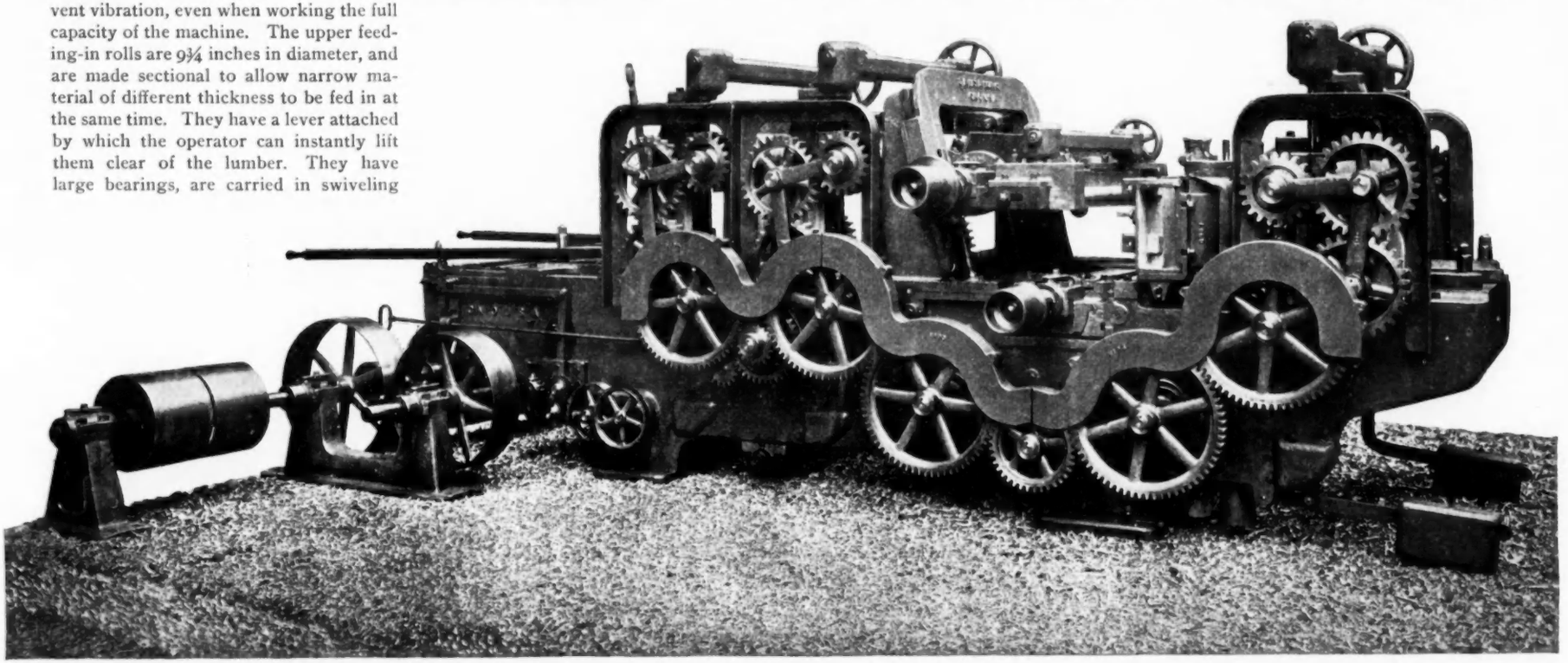
Six-Roll, Double-Cylinder Surfacer and Jointer.

We give herewith an illustration of an unusually large and complete machine of its class, designed for sizing the largest dimension timbers, and for doing all surfacing as well.

The frame is heavy and braced to prevent vibration, even when working the full capacity of the machine. The upper feeding-in rolls are 9¾ inches in diameter, and are made sectional to allow narrow material of different thickness to be fed in at the same time. They have a lever attached by which the operator can instantly lift them clear of the lumber. They have large bearings, are carried in swiveling boxes, and have heavy double expansion gearing, yoked both inside and out, to insure steady running. The equalizing weights drop on cushions to relieve the strain and prevent shearing the fulcrum bolts. The lower feeding-in rolls are 9¾ inches in diameter and are adjustable by means of set screws placed under the boxes. The pressure bar, before the cut, is made sectional and is arranged to lift easily for any variation of thickness up to 3 inches, and is adjustable to and from the cut to allow the knives to project in working ship lap, etc. The bar, after the cut, acts also as the bar over the lower cylinder, is adjustable to and from the cut, and has an independent vertical adjustment. After being set, this bar needs no changing when a different thickness of material is to be planed; it always being retained in the same position relative to the cut. Two pressure rolls, arranged to give more or less pressure as desired, are carried one before and one after this bar, and to plane heavy timbers this bar is raised out of the way and the rollers act on the material with less friction than would the bar.

The upper cylinder is four-sided and slotted, and has journals 3 inches diameter by 12 inches long. The bearings are yoked together overhead and held perfectly true with the stands by gibs on each side, and are locked from the feeding in end of the machine. The cylinder-raising screws are carried on ball bearings so as to be readily adjusted by hand when desired. The lower cylinder is four-sided and slotted, has journals 3 inches in diameter by 12 inches long, can be withdrawn on the operator's side for sharpening and adjusting the knives, and is held secure by an improved locking device.

The side heads are 14 or 16 inches long, as desired, and have each an adjustment clip which allows the chip-breaking lip to be brought close to the cut. This clip can be lifted off, to give access to the knives, by loosening two bolts, and is weighted by an improved lever arrangment which does away with the wire rope. Pressure feet are attached one after each head, reaching out past the center, and one to the bar over the lower cylinder, which reaches out between the side heads for use on wide material. The spindles have each three bearings; the one close to the top, which is $2\frac{3}{16}$ inches diameter by 8¼ inches long, can be quickly removed for changing heads. The hangers are carried on heavy



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chain. The chain wheel should not be fixed on the axle, whereby the driving stress is communicated through the hub and spokes, but it ought to be fixed well towards the rim of the wheel and set clear of the mud or dust, so that the chain may pull as closely as possible to the point of application of the tire to the road.

Continental makers favor the use of copper and brass where I think in England and America we should use pressed sheet steel and light steel castings, for it is certain that the motor carriage industry will bring about many interesting innovations in construction, chiefly with a view to lightness of parts and safety as regards the containers for the oil. That the permanent type of vehicle has yet been made is far from likely. The horse has been removed and the vehicle remains, but it is a horse carriage yet, and only wants the shafts to be added. It reminds one in a sense of early railroad cars, which often resembled old stage bodies, but upon different wheels. The original mind is wanting who shall design the future self-propelling carriage.

A Compound Yacht Engine.

We illustrate this week an interesting compound yacht engine built by Morton, Reed & Co., Baltimore, Md., for the yacht "Otronto," owned by W. H. Evans, of Baltimore.

The original engine of the "Otronto" was a compound, with cylinders 5½ inches and 11 inches x 6-inch stroke, and the present engine with cylinders 7 inches and 13 x 8 inches, was designed to take the place of the former, occupying no more room fore and aft. The base is 33¼ x 27 inches, the height of the engine is 52 inches, and the weight is 2,030 pounds. The engine is designed to be solid and durable and able to run 24 hours per day, as frequent runs to the Capes (200 miles) are made by the owner.

There are two supporting columns on the starboard side 2¼ inches diameter, and three on the port side 2 inches diameter. This construction leaves the whole side of the engine open, so that the engineer can easily get at every bearing, and in handling he does not move from his position to reach throttle lever, reverse bar or by-pass valve.

The cylinders are separate castings bolted together by four large main bolts; the exhaust from the high-pressure cylinder passes through the joint faces of the two cylinders, the opening having six bolts around similar to a flange joint, the joint being scraped and smeared with plumbago grease; the bolts entering the exhaust passage can be reached by taking off the cover seen under the by-pass valve. The pistons are hollow castings with plain spring rings, as in high-speed stationary engine practice.

The Marshall valve gear is used, operating solid piston valves. Fig. 1 shows the valve gear in the "go ahead" position, and Fig. 2 to "go astern."

The by-pass valve is made large, and provides that in case of accident to the high-pressure engine its valve may be disconnected and set central over the ports, when the low-pressure engine may be run alone. If the low-pressure side is deranged its valve may be disconnected and pushed to the top, and the high press-

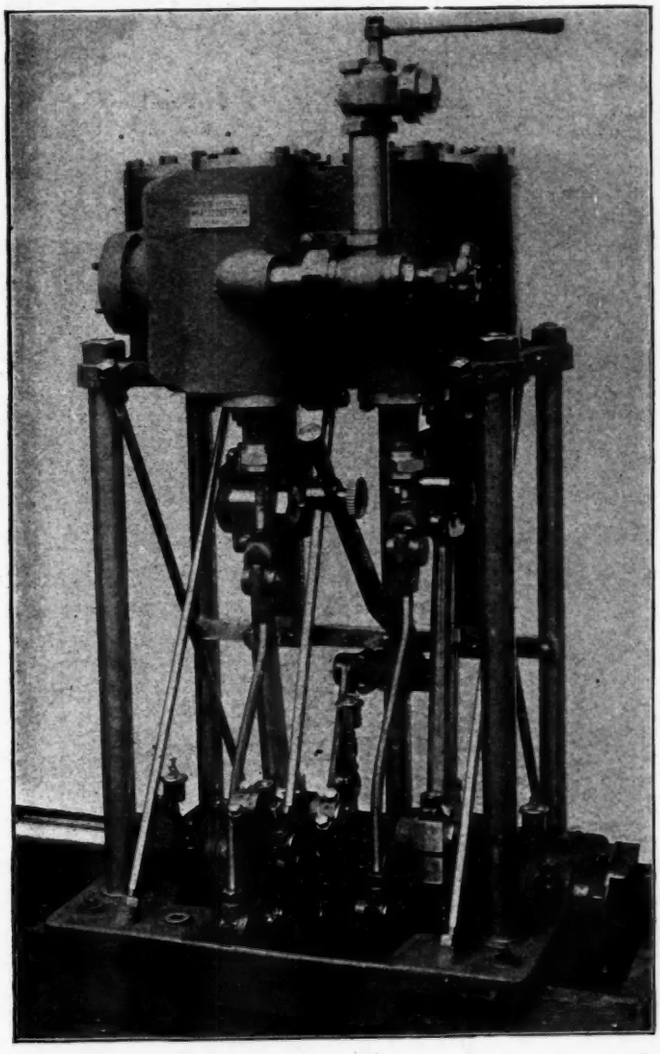

Fig. 1. Go-ahead Position.

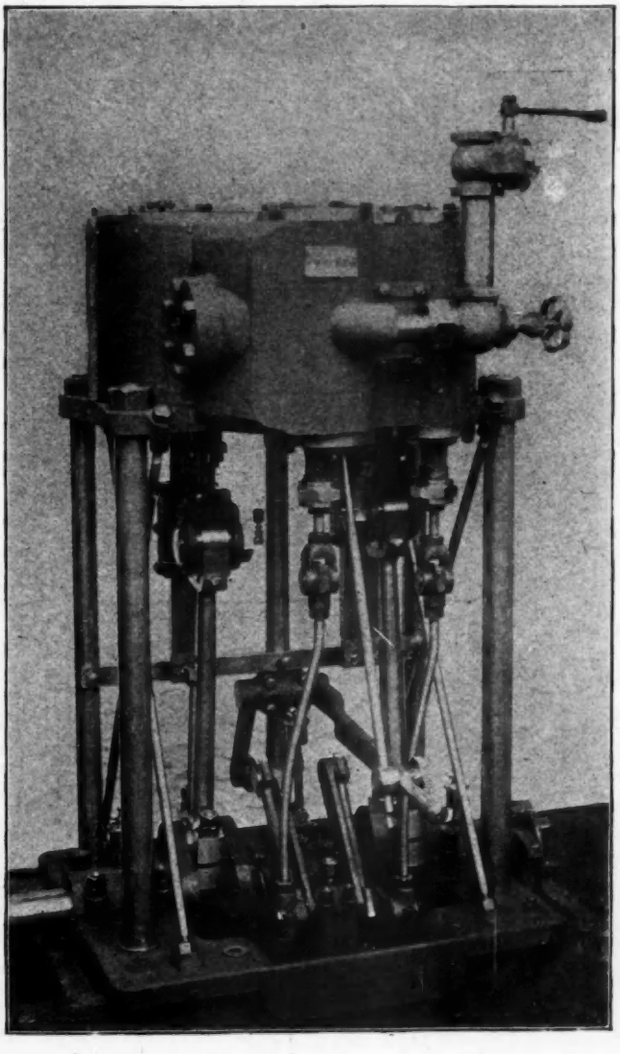

Fig. 2. Go-astern Position.

A COMPOUND YACHT ENGINE.

ure then run alone, exhausting into the condenser through the low-pressure chest.

The crossheads, connecting rods, shaft and valve gearing are open-hearth steel castings. The columns, braces, valve rods, crosshead guides and crossbars are of cold-rolled steel with the surfaces left as they come from the mill.

steam, driving a wheel 44 inches diameter and 5 feet 9 inches pitch. The yacht is 76 feet long, 10½ feet beam, 4 feet draught, and with this engine will make over 14 miles per hour.

In addition to the half-tones we give a plan of the engine and elevations of the starboard side and forward end.

Astonishing results are obtained by it as compared with the single-plane kite. Metrological observations with recording apparatus are carried on at considerable elevations, and kite photography is now quite common.

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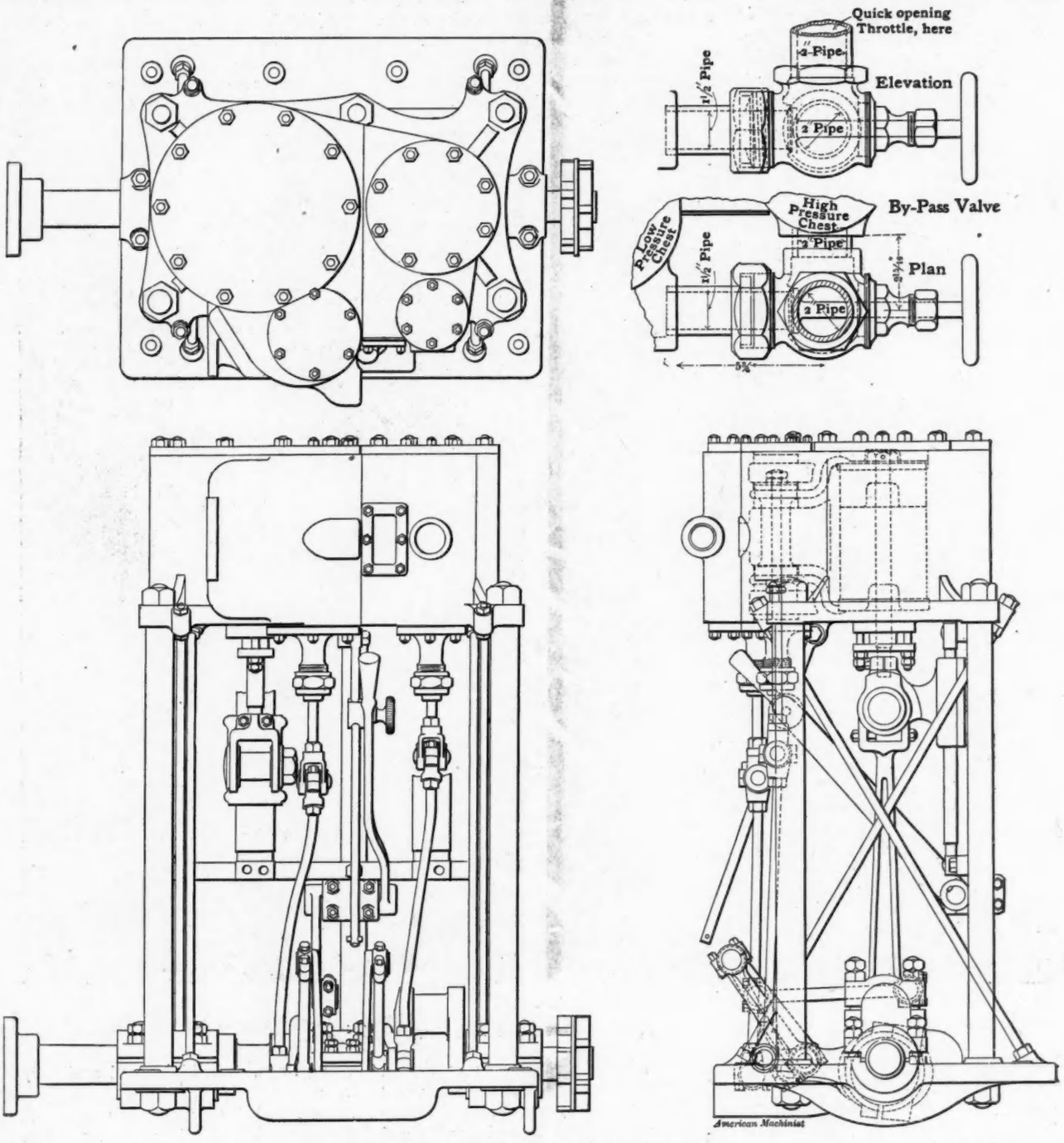
Business is reported to be exceptionally



PLAN AND ELEVATION OF YACHT ENGINE.

The bearings of the valve gear are made adjustable and so that wear will keep the valves in the same relative position. The bearings are large and the stuffing boxes are deep. Oiling devices, not shown, convey oil to all bearings when running.

The engine is made to run at 300 revolutions per minute with 175 pounds of

Rapid progress seems to be making at the present time in aëronautics, and the era of practical flight for mankind is coming visibly nearer. The navigable balloon idea seems to have been generally abandoned, as it should have been long ago. The latest and apparently most promising development is in the double-plane kite.

good in all branches of the machine business in Great Britain. Engine machine tool and textile machinists are busy and wages are advancing.

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The "Out of Employment" lists of the unions have nearly disappeared, it is said.

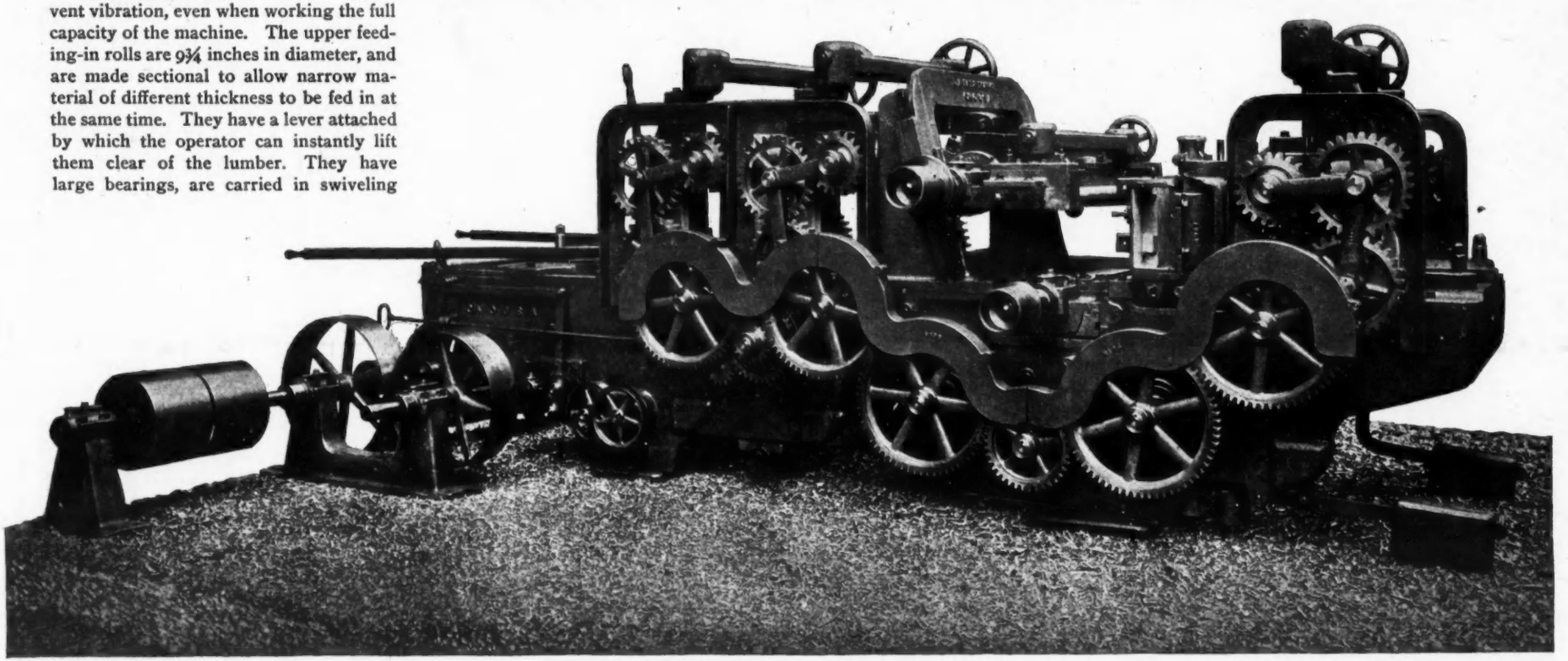
Six-Roll, Double-Cylinder Surfacer and Jointer.

We give herewith an illustration of an unusually large and complete machine of its class, designed for sizing the largest dimension timbers, and for doing all surfacing as well.

The frame is heavy and braced to prevent vibration, even when working the full capacity of the machine. The upper feeding-in rolls are 9¾ inches in diameter, and are made sectional to allow narrow material of different thickness to be fed in at the same time. They have a lever attached by which the operator can instantly lift them clear of the lumber. They have large bearings, are carried in swiveling boxes, and have heavy double expansion gearing, yoked both inside and out, to insure steady running. The equalizing weights drop on cushions to relieve the strain and prevent shearing the fulcrum bolts. The lower feeding-in rolls are 9¾ inches in diameter and are adjustable by means of set screws placed under the boxes. The pressure bar, before the cut, is made sectional and is arranged to lift easily for any variation of thickness up to 3 inches, and is adjustable to and from the cut to allow the knives to project in working ship lap, etc. The bar, after the cut, acts also as the bar over the lower cylinder, is adjustable to and from the cut, and has an independent vertical adjustment. After being set, this bar needs no changing when a different thickness of material is to be planed; it always being retained in the same position relative to the cut. Two pressure rolls, arranged to give more or less pressure as desired, are carried one before and one after this bar, and to plane heavy timbers this bar is raised out of the way and the rollers act on the material with less friction than would the bar.

The upper cylinder is four-sided and slotted, and has journals 3 inches diameter by 12 inches long. The bearings are yoked together overhead and held perfectly true with the stands by gibs on each side, and are locked from the feeding in end of the machine. The cylinder-raising screws are carried on ball bearings so as to be readily adjusted by hand when desired. The lower cylinder is four-sided and slotted, has journals 3 inches in diameter by 12 inches long, can be withdrawn on the operator's side for sharpening and adjusting the knives, and is held secure by an improved locking device.

The side heads are 14 or 16 inches long, as desired, and have each an adjustment clip which allows the chip-breaking lip to be brought close to the cut. This clip can be lifted off, to give access to the knives, by loosening two bolts, and is weighted by an improved lever arrangment which does away with the wire rope. Pressure feet are attached one after each head, reaching out past the center, and one to the bar over the lower cylinder, which reaches out between the side heads for use on wide material. The spindles have each three bearings; the one close to the top, which is $2\frac{3}{16}$ inches diameter by 8¼ inches long, can be quickly removed for changing heads. The hangers are carried on heavy



SIX-ROLL, DOUBLE-CYLINDER SURFACER AND JOINTER.

gibs planed true, are adjusted and locked either from the feeding-in end or side of the machine, have a gage placed conveniently to the operator which accurately marks the position of the heads, and each has an adjustable plate which is raised to suit the cut of the lower cylinder. The lower bearing or step is arranged to run in oil so as not to heat. Feeding-out guides are arranged to move with the hangers.

The upper feeding-out roll is 9¾ inches diameter, is carried in swivelling boxes, has heavy double-expansion gearing yoked inside and out, and a roll cover arranged to brush off the lumber before passing under the roll, and a scraper for cleaning the roll. The weighting attachment drops to the floor to relieve the strain. The lower feeding-out roll is 9¾ inches diameter, is adjustable vertically, and has a scraper attached.

The feed is controlled by the operator by means of two levers; one for starting and one for shifting across the friction plate for changing the feed or reversing it so as to withdraw the lumber from the machine. The variable feed countershaft regulates the feed anywhere between nothing and 110 feet per minute, and reverses it when desired. It can be placed either overhead or below the floor. Idler rolls, to relieve the friction of heavy timbers, are placed one on the feeding-in girt and one in the feeding-in platen; each end is cushioned to lessen the liability of breakage when heavy timbers are dropped on them. Guides are furnished, one on the right side and one in the center, by which two pieces 13 inches wide can be worked on three sides at the same time. When it is desired to plane four sides, using the center guide, by removing a bolt a section at the feeding-out end can be removed to permit the matcher hanger to be moved across. The power-raising attachment is operated by a lever at the feeding-in end of the machine, a gage to indicate the thickness being placed where it can be easily read by the operator. All the upper rolls and the upper cylinder can be raised and lowered together, or the upper cylinder and feeding-out roll disconnected and moved by hand. The weight of the machine is 23,500 pounds. It is made by the J. A. Fay & Egan Co., Cincinnati, O.

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A trip for record purposes was recently made from London to Paris, special service being employed throughout. The entire distance was covered in 6 hours 32 minutes. From Victoria Station, London, to Dover, 78½ miles, was made in 1 hour 22 minutes 35 seconds, or at 59.9 miles per hour; from Dover to Calais, 25 miles, was made in an hour and a quarter, or at 20 miles per hour; and from Calais to Paris, 185½ miles, was done in 3 hours 34 minutes, or at 52 miles per hour, including three stops.

Graduations on Taper Attachments and Grinders—A Way to Make V-Slides—A Lathe Board.

There are some strange features about our present practice of graduating taper attachments and universal grinding machines, and I suppose, Mr. Editor, that if you were not already familiar with the fact you would be somewhat shocked at a statement that such graduating is almost never done right. This is the truth of the matter, however, as a little investigation will readily show. The error arises from the fact that we measure "taper per foot" on straight lines which are at right angles to the center line of the work, but we don't arrange the graduations that way; instead, we place them on an arc of a circle, spacing them evenly; they give wrong results, and then some of us wonder why. The reason why ought to be plain enough after a little study of Fig. 1, wherein we will imagine we have a piece of work a foot long and with a taper of 12 inches per foot, this excessive taper being chosen in order to make the diagram plainer; now, when we measure such a piece to determine its taper per foot we

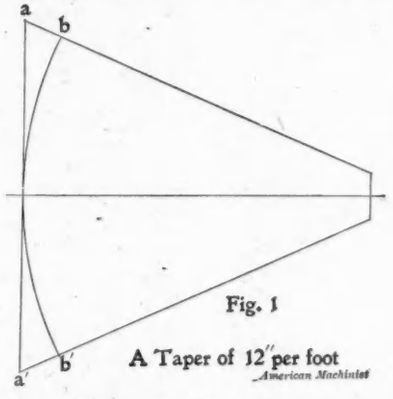

Fig. 1

A Taper of 12" per foot

American Machinist

measure the large end of it by applying our calipers to the points $a\ a^1$, and when we graduate our taper attachments and our universal grinding machines and our cutter grinders we graduate them as though we measured taper per foot on the curved line $b\ b^1$; which we don't at all.

In the "American Machinist" of February 11, 1892, a correspondent called attention to this error and said that it must be that, in order to be correct, such graduations, if placed on an arc of a circle, must be unevenly spaced, and you, Mr. Editor, gave a diagram which clearly showed the reason for it and the principle upon which a fixture for such uneven graduating must be made. Yet the graduating has been done in the same old way, and only recently have I noticed a disposition to do something better.

Oakley S. Walker, the machine designer for the Norton Emery Wheel Co., has overcome the difficulty on his universal cutter grinder in a very original way; a way which, though it gives exactly the same effect as though the graduations were unevenly and properly spaced upon an arc of a circle, yet permits the use of a simple, straight, evenly divided steel rule for the graduations. This has the appearance of being done simply to save cost of construction, but is one of those cases in which appearances are deceitful, as some of the mechanics who have seen this machine have discovered, when they attempted to convince Mr. Walker that he was wrong about these graduations. They have so far failed to convince him, and at my request Mr. Walker has made a few diagrams and written some explanation of the principles involved. He says:

"Figs. 2 and 3 are plan views of a grinder platen, showing two different styles of graduations for setting same for taper per foot. Both these styles of graduations are correct. The common fallacy seems to be to graduate or to fasten graduated scales to the curved end of the taper bar or swivel platen. Such graduations, if evenly spaced, introduce an error into the mechanism, as I will proceed to demonstrate.

"In Fig. 4 is shown an outline of the method of laying out tapers, the angle shown being the amount of set-over for a taper of 3 inches per foot, the actual distance set over, of course, being one-half the taper to be turned or ground. $F\ G$ is the base line (corresponding to the axis of the work), and the distance set over is to be measured at right angles to same or on the line $F\ H$; in this case 1½ inches for 3 inches per foot taper. It will be noticed, in Figs. 2 and 3, that the system of straight scales and index pointers indicates tapers in precisely this manner. In Fig. 2 the readings are taken from the side of the index pointer and the inner edge of the scale.

"In Fig. 5 is shown a diagram illustrating the error of placing evenly spaced graduations on the arc of a circle. The part of the diagram below the line $x\ y$ shows evenly spaced divisions on the straight line $a\ b$, and illustrates the proper spacing for graduations on the arc $b\ d$, which are plainly of a gradually diminishing ratio of spacing. The portion of the diagram above the line $x\ y$ shows even graduations of the arc $b\ c$ (a fac-simile of the arc $b\ d$), or shows the same effect as bending a scale about the end of a taper bar, the varying spaces on the straight line $f\ e$ showing the resultant error (easily detected by the eye) of this system."

Fig. 2 shows the actual construction of the cutter grinder referred to, which I first saw at the Chicago World's Fair and then satisfied myself was right. It was not quite so clear to me that the method shown in Fig. 3 was right until I had applied my favorite plan of carrying things to extremes to see how they come out, which resulted in the diagram Fig. 6, wherein the curve $a\ a^1$ may be supposed to represent the curved end of a swinging platen on such a grinder, and the line $b\ b^1$ the inner edge of a straight scale. The platen in this case is supposed to turn on

the center *c*, and by spacing the lines of the scale evenly on the inner edge, as I have done, and then having the pointer long enough to reach over and travel on the arc *b d*, it is evident enough that the same effect is produced that we have in the construction shown in Fig. 2, where the reading must always be done at the edge of the scale, instead of at the end of the pointer.

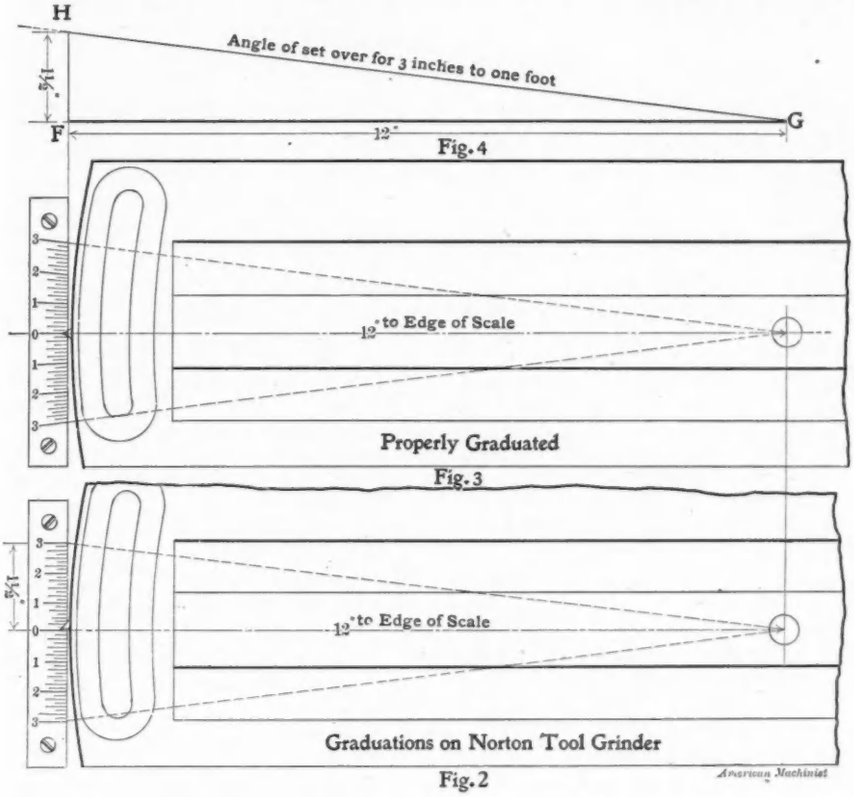

Fig. 4
Fig. 3
Fig. 2

There is at least one lathe builder who is graduating his taper attachments correctly, however, and that is Mr. Earl, of Blaisdell & Co., Worcester. Mr. Earl places his graduations upon the arc at the end of the taper bar, as usual, but spaces them unevenly and properly by means of a special device which he was unwilling to show to me; but I know that he makes use of the principle outlined in Fig. 5, because he showed me a blueprint of one of his schemes for doing the work, part of which scheme was to have holes located in arcs of circles of large radius, and on radial lines laid out from spaces evenly made on a straight line. A stop inserted in these holes, one after the other, was to give the spacing required. This particular scheme was, however, discarded for something thought to be more practical for shop use.

A SPECIAL DEVICE FOR SPECIAL GRADUATING.

I don't know that I am called upon to suggest a device for this purpose, but, as I write, an idea suggests itself to me which it may be worth while to present, since it seems to be the obvious way to do such graduating. Suppose we want to make a device for graduating the end of a taper bar or the swivel plate of a grinder so that it will read taper per foot correctly, and we make a circular table *a* which can turn freely about the center *c*: Across the face of this circular table we plane a dovetail groove, and to this groove we fit the sliding arm *d*. The outer end of this arm can be attached to a sliding block which is moved by the screw *s*. Now, it is plain that if, by this screw *s*, the sliding block be made to move equal distances for each graduation, the plate *a* will be moved through unequal arcs, and these unequal arcs will be just right for the graduations we want to make; and if the work be set so that the surface to be graduated is just the same distance from the center of the plate *a* as the point of attachment *e* is when in its mid-position as shown, the indexing arrangements for the movement of the screw can be very simple. To facilitate doing this it would probably be better to arrange so that the distance between the sliding block and the center of the plate could be adjusted to suit the job in hand.

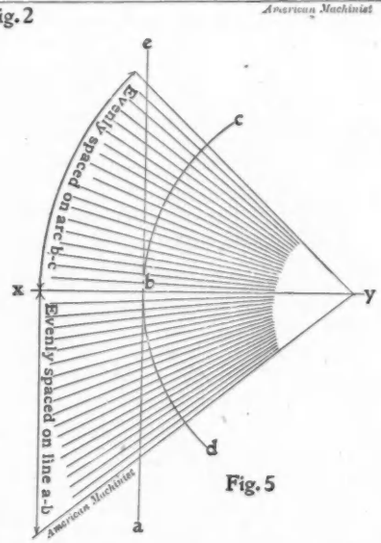

Fig. 5

DIAGRAM SHOWING RIGHT AND WRONG WAYS TO GRADUATE.

The dotted lines in Fig. 7 show the effect of turning the screw, and I do not see why this fixture would not give precisely accurate results if well made with an accurate screw. It could even be made to work automatically without much trouble, and, with the enthusiasm of the true inventor, it seems to me that the existence of this sketch ought to leave no valid excuse for the kind of the graduating that has been usually done where taper per foot is to be indicated.

Some of the diagrams here given exaggerate the error in order to make it plain, but there is sufficient actual error to make itself very plainly manifest in actual work.

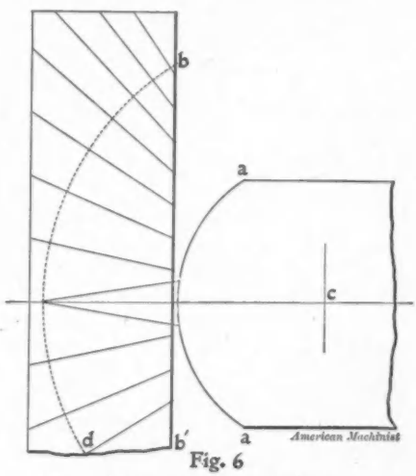

Fig. 6

An exaggeration of Fig. 3

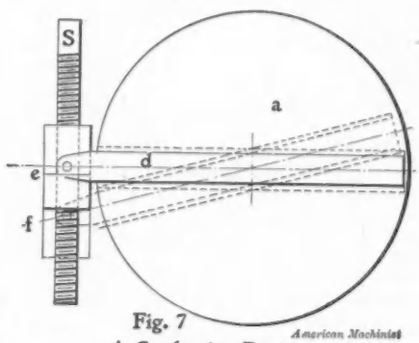

Fig. 7

A Graduating Device

And let no one imagine that a greater radius of the graduated bar or plate helps the matter in the least, for it does not; it is simply a matter of the angle or the amount of taper per foot, regardless of the radius upon which it is measured.

AN ARRANGEMENT OF V-SLIDES.

There is another feature of this grinder of Mr. Walker's which interested me considerably, because it is one of those things we often see in machine construction that

has more in it than appears on the surface. At Fig. 8 I give a sketch showing the arrangement of the V-slides for the platen. It will be noticed that, instead of having the prisms both on the upper piece, or platen, as is usual, and the grooves in the lower piece, there is an impartial distribution of these features, one of the V's being simply turned upside down, so to speak. The most important result of this arrangement is that both pieces are precisely alike, and when they are planed, one is placed behind the other on the planer platen, so that they are planed together. A somewhat curious and interesting thing results from this scheme, and that is, that, barring springing of the work in fastening it to the platen, it is really easier to make the prisms fit the V-grooves than to make them so that they will not fit, and I have done enough planer work to know what this means. The matter will be readily understood from the sketch Fig. 9, wherein we may imagine the upper piece (the platen), shown in Fig. 8, turned over and clamped to the planer platen. Now, if we imagine the

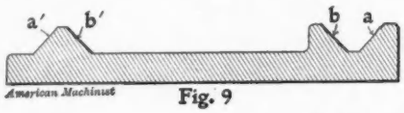

Fig. 9

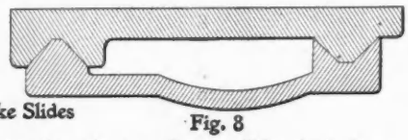
Fig. 8

A way to make Slides

lower piece (the bed), shown in Fig. 8 also, placed behind the platen, but without being turned over, we have the situation. The beveled surface *a* of the platen may then be planed, and the bed being behind the platen, the corresponding surface of the bed is planed at the same time. Now, without disturbing the setting of the tool, it is run over, and the beveled surface a^1 of the platen is planed, and with it the beveled surface of the bed which is to fit the beveled surface of the platen just planed. The tool is then swung over to the other angle, and the surfaces *b* and b^1 are planed with same setting of the tool; the general result being that, no matter even if the angles as set on the planer head vary from each other considerably, the surfaces will still fit each other accurately, because any given pair of surfaces which are to be in contact with each other in the machine are planed at the same setting of the planer tool; and, moreover, the distances from prism to groove must necessarily be right and cannot be made wrong.

The present practice is to plane this work; but if it were to be milled, then another important advantage of this arrangement of things would show itself; since one single gang of cutters would answer for both pieces, and not only the first cost of cutters would thus be cut in half, but it would be much easier to keep them in shape to do satisfactory work.

THE SAME PRINCIPLE DIFFERENTLY APPLIED.

This reminds me that Mr. J. A. MacGregor took advantage of this principle in a very neat manner when he was reorganizing the system of manufacture for the Harrington hoist. The worm gearing of this hoist is cased up tight, and there is a joint at the center which it is, of course, desirable to have as tight as possible so that it will not leak oil. In order to properly locate the different parts it was necessary that the case should be tongued and grooved at the joint, and the usual way of doing this would be to make the tongues on one side of the case and the grooves on the other, as shown in Fig. 10. This, as we all know, would require two gangs of milling cutters, correspondingly shaped, and it would be a job to tax the skill of a first-class man to keep them to such close conformity with each other as to give satisfactory results. By simply putting a tongue and a groove on each part of the case, as shown in Fig. 11, the two pieces are made alike; there is only one milling cut to make, instead of two, and one gang of cutters does the business.

A GOOD LATHE BOARD.

Someone inquired a while ago for ideas about lathe boards. I saw a good one in the Norton Emery Wheel Co.'s machine shop, and give three views of it at Figs. 12, 13 and 14. Mr. Walker kindly furnished the blueprint and describes it as follows:

"Fig. 12 shows a plan view, Fig. 13 a front elevation, and Fig. 14 an end elevation. This lathe board is entirely constructed of wood, *A* being the bottom board, which rests upon the latheways (see Fig. 14). Side strips about 4 inches high are provided, upon which is mounted the sliding lid *B*, moving upon the ways *C*, which project in the back and are screwed to the side strips before mentioned. This lid is made for the reception of small parts of machines in process of construction, tools such as calipers, scales, etc., or for a convenient place to adjust a drawing. All the lathe tools are designed to be placed underneath upon the board *A*, with cutting ends to the front as shown. *D* is an open-ended box for the reception of waste. *E* is a shelf for crayons, bits of copper, tin, sheet iron, etc., which could not appear in a shop's inventory or assets to the value of a single cent, yet without which no lathe could be operated. *F* is a shelf for the oil can."

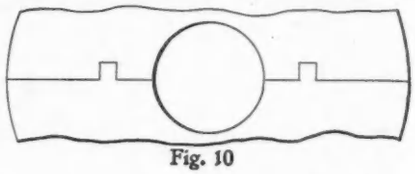
Fig. 10

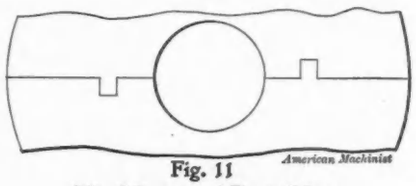

Fig. 11

The Wrong and Right Ways

I have known men to spend a good deal of money for features on lathes designed to facilitate the work of the lathesman, and then compel him to get along with a make-shift arrangement for a latheboard, which wasted more of his time than the aforesaid special features of the lathe could possibly save. Such men may very well spend a little time in examining the above

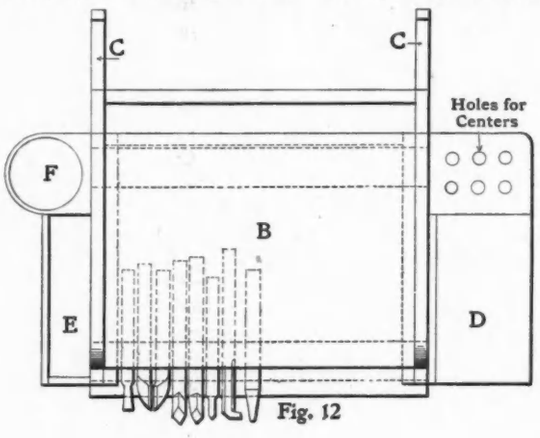

Fig. 12

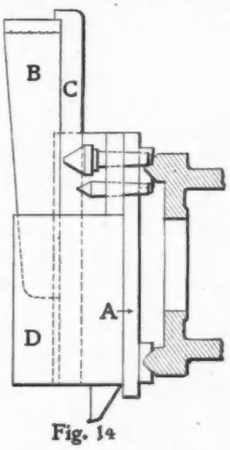

Fig. 14

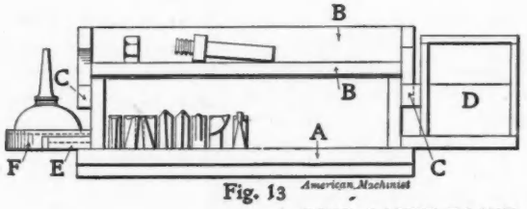

Fig. 13

A GOOD LATHE BOARD.

drawing and observing how well adapted this board is to the important work of tempting men to have a place for things and to keep them there, so that when they are wanted no time need be lost in getting them.

There are a good many lathes in use in this country, and a good many additional ones are going into use every day. If a man were to rig up for it a little, he could make these boards in large lots, and sell them at a profit for less than they would cost made one at a time in the pattern shop; and I feel pretty confident that every lathe owner, capable of understanding the advantage of such lathe boards, would speedily equip his lathes with them, and keep a few extra ones on hand so he wouldn't have to wait for one in case he should buy a new lathe.

S. T. FREELAND.

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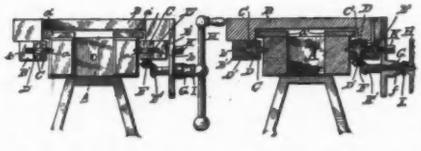
A Worthless Patent on a Worthless Invention.

Some time ago we mentioned that David Cornell, of North Fork, Pa., had won the monthly prize of $50 offered by John Wedderburn & Co. for the best and most practical invention patented through their agency as attorneys.

Mr. Cornell, the inventor, wishes us to publish an engraving of the invention, and we do so herewith. It is designed to support a lathe carriage on four rollers like those shown, and the scheme is a manifest absurdity, of no value whatever for the purpose intended, though some day, in some way not now evident, this patent might stand in the way of a meri-



torious scheme by a skilled machine designer, and might have to be purchased; that is to say, it might have to be if the patent really covers the device. Mechanically, and as a lathe improvement, the thing is worthless.

And now as to the patent, irrespective of the mechanical merits of the invention: It may be interesting, and to some instructive also, to examine that a little. The broadest claim in this patent is the third one, which reads as follows:

"The combination with the bed with its longitudinal grooves, of the carriage provided with guide-rollers on vertical shafts, a beveled pinion on one of said shafts and a horizontal shaft carrying a beveled pinion and a crank handle, and an apron screwed to said carriage and provided with means for moving same back and forth, and screws carried by said apron constructed and arranged to hold the carriage fast to the bed, substantially as and for the purposes specified."

Anyone familiar with such matters will recognize this as a "combination claim"—i. e., a claim on a combination of things taken together—and that if any single one of the things making this combination is omitted or materially changed, the patent is not infringed. If there is anything new in this device, it is the rollers upon which the carriage is supported; and if we can imagine (without stretching our imagination too violently) that any lathe builder might want to use these rollers for that purpose, he could do so with perfect impunity so far as this patent is concerned. All he would need to do would be, for instance, to disconnect the horizontal shaft, bevel pinions, etc., from the one roll and connect the crank handle to a rack in the ordinary manner, which would be much better mechanically, and the combination would thus be broken so that there would be no infringement. In other words, supposing the rolls to be good for the purpose shown (which they are not), then this patent does not cover their use at all, but only their use in connection with all the other things mentioned in the claim.

We point out these facts only because it seems to be a case easily understood and typical of a great number of patents that are taken out, that are utterly worthless from the mechanical and the legal as well as from the commercial point of view. The worthlessness of such patents is by no means always the fault of the attorney, however. Many people demand patents upon their inventions, and must have them. In many cases it is impossible to get good patents, and then worthless ones are obtained to supply the demand. It is, however, equally true that worthless patents are in many cases obtained where it would be just as easy to get good ones, if the attorney were competent and honest. Some attorneys think it their duty to advise against application for patents which they know will be worthless; others do not believe this is any part of a patent attorney's duty, and that his sole duty is to go ahead and get the best patent possible. One of the former class would have advised against this application.

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The Elastic Limit.

We condense the following from an article on "The Mechanical Testing of Iron and Steel," in "Science Progress:"

"No term has given rise to more confusion in dealing with the strength of materials than 'limit of elasticity.' By stressing a bar in tension beyond its yielding point, we raise its limit of elasticity in tension, and that has usually been considered to represent the whole result of the action. There is for any given material a true natural limit of elasticity, but this natural limit may be varied in all sorts of ways—by strains set up during manufacture, by after working, or in the testing machine—and unless we know the whole history of the bar we are testing, we are unable to say whether the limit shown by our test is a natural one, or whether produced by some treatment to which the bar has been subjected. In one form this fact has been appreciated. It is well known that cold rolling greatly raises the limit, and more for bars of smaller section than for those of larger section. But it has not been generally understood that this case is only a single fact under a wider general law. A recognition of this throws light upon the actual value of elastic limits determined only from static tensile tests. High values so obtained are often made the basis of claims for higher working stresses, even for alternating tension and compression. A steady change in the opinion of engineers in regard to the question of working stresses has been in progress for the past few years, and at present we are still groping more or less, in the dark, because, though there is a mass of rapidly accumulating data, it at present seems largely to be only capable of being used in a more or less empirical fashion, and to be still in need of some rational explanation."

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Speed of Milling Cutters.

For the cutting speed of milling cutters in good German practice the following rule is given: Revolutions per minute $= C \div$ diameter of the cutter in inches. The value of C varies with the material. For cast iron or cast steel $C =$ about 200, for wrought iron 200 to 240, for hard brass 320 to 340, and somewhat greater for soft brass. The resulting speeds are: For cast iron and cast steel 52 feet per minute, for wrought iron 52 to 62, and for hard brass 62 to 89. The feed per minute for cast iron, wrought iron or steel is from 0.6 to 1.2 inch, and for brass 2 inches or more. The classing of cast iron and steel together may seem strange, but probably a lubricant is used for steel and not for cast iron.

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The Bureau of Statistics at Berlin has collected the following general information concerning the steam engines of the world:

"Of the steam engines now working in the world, four-fifths have been constructed during the last twenty-five years. France has 75,590 stationary and locomotive boilers, 1,850 boat boilers and 7,000 locomotives; Germany, 59,000 land boilers, 1,700 ship boilers and 10,000 locomotives; Austria, 12,000 boilers and 2,800 locomotives. The working steam engines of the United States represent 7,500,000 horse-power; of England, 7,000,000 horse-power; Germany, 4,500,000 horse-power; France, 3,000,000 horse-power; Austria, 1,500,000 horse-power. The whole number of locomotives in the world is estimated at 105,000, representing a total of 3,000,000 horse-power; and the world's steam engines aggregate more than 26,000,000 horse-power."

ELECTRICAL MACHINERY.

Building of a Great Dynamo.—X.

The cable-covering machine is shown in Fig. 36. The wire, already covered with insulating material, is brought to the machine on a reel, from which it passes through the hollow "flyer" spindle driven by the pulley *B*. The wire does not touch this hollow spindle, but simply passes through it, and is covered with the tape as it goes. Leaving the flyer spindle, the covered wire passes in several turns around the holding wheel *C*, and is then led to a receiving drum, on which the covered wire is finally wound by a very light friction drive, barely strong enough to keep up the slack of the covered wire. *C* has to be driven at a speed exactly proportioned to the width of the tape used in covering, so that the tape will not lap on itself and yet will cover the wire closely. This feed drive for *C* is had through a round belt from a sheave fast to the outside of the flyer driving pulley *B*, leading down to a large sheave on a shaft below the frame of the machine, from which *C* is driven by a small worm gear. The wire is led into the hollow spindle through two grooved rollers on top of the stand *F*, which are set up closely enough together to hold the wire so firmly that it will not turn round easily, and these rollers also have enough friction on them to hold the wire taut and straight between *C* and *F*. The flyer itself is fastened by a curved slotted piece to a square block fast on the nose of the flyer spindle, and the nose of the flyer spindle is extended by a mortised bushing which has an internal bore just large enough to turn freely around the covered wire; this mortised bushing is fast in the spindle and turns with it. The covering tape enters the mortise in line with the delivery point of the bobbin. The tape bobbin-carrier is pivoted to the curved slotted supporting arm so it can be set at the proper angle to make the tape deliver smoothly to the wire on which the tape is being wound, and the bobbin-carrier has an adjustable friction band, by means of which the tightness of the tape winding on the wire is regulated. A counterbalance arm is screwed to one side of the square flyer block, and the counterweight is made of a long bolt filled with rough machine washers. The wire to be covered does not revolve, but is simply pulled along through the flyer spindle while the flyer spindle and tape bobbin revolve around the wire and wind the tape on it. This is a very ordinary machine, and is thus minutely described because it involves all the elements of wire-covering with tape, and hence may be a useful example to some readers who do not have access to such machines.

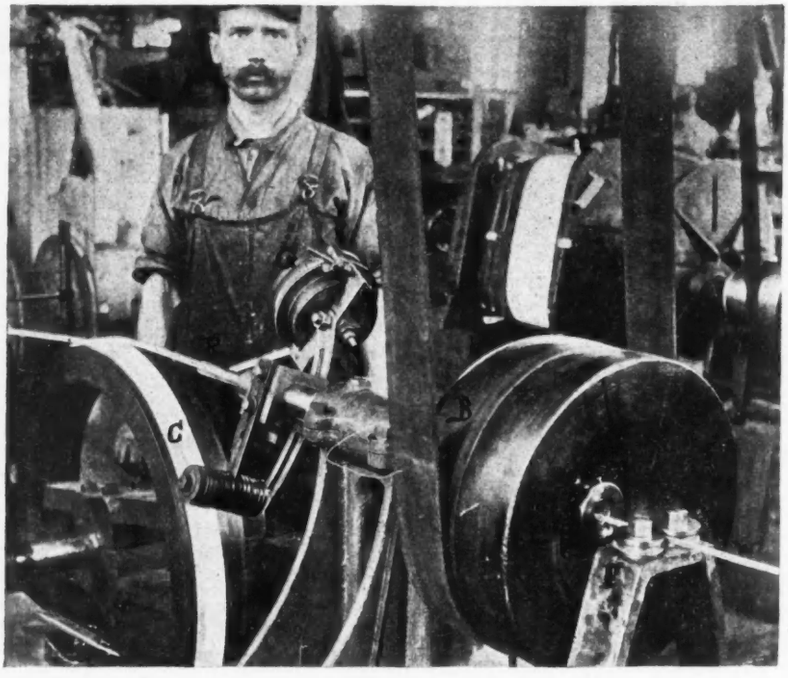

Fig. 36. CABLE-COVERING MACHINE.

Fig. 37 shows the process of magnet-winding, which is done on forms in slow-running lathes, commonly friction-driven and treadle-controlled, the wire being carefully attended and laid by the operator as the winding proceeds. Each full layer of the winding is painted with "P. & D." paint—composition not known to the writer.

Two boxes in Fig. 35 are shown with shunt-winding only, and some with both the shunt and the series winding. Like all the other steps in dynamo-making, the magnet-winding must be rightly done, and is the subject of great care and patient manipulation. "Winding" varies greatly in different makes and systems of dynamos; in some cases long banks of highly specialized lathes are attended by girls, who are very neat and expert in the art. The shapes into which the winding is made are also extremely various, so that the practice and winding tools of each shop where dynamos are built is a thing by itself. Probably the forms of dynamos will be unified and concentrated into very few types in the course of time; and probably, also, there will then be a much nearer approach to settled forms of tools used in making dynamos of the same type. Now all is comparatively of recent devising and diverse methods are natural. When extended knowledge of any manufacture becomes general, there is always a tendency towards uniformity in tools and methods, because there is, after all, only one best way to do a thing, no matter how many

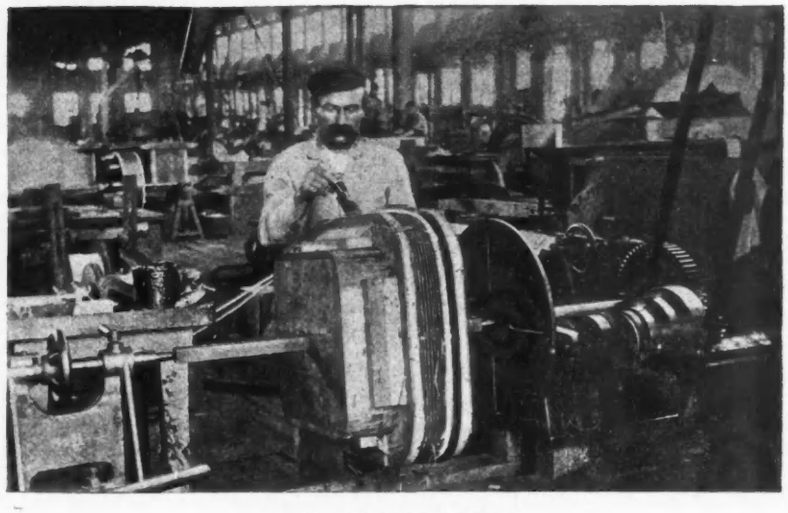

Fig. 37. SERIES WINDING.

possible ways there may be, or how many different ways have been used by good men to accomplish the purpose. The winding is finally tested with a 10,000-volt alternating current.

Fig. 38 shows the center magnet on the floor, complete except the "poleshoes" or

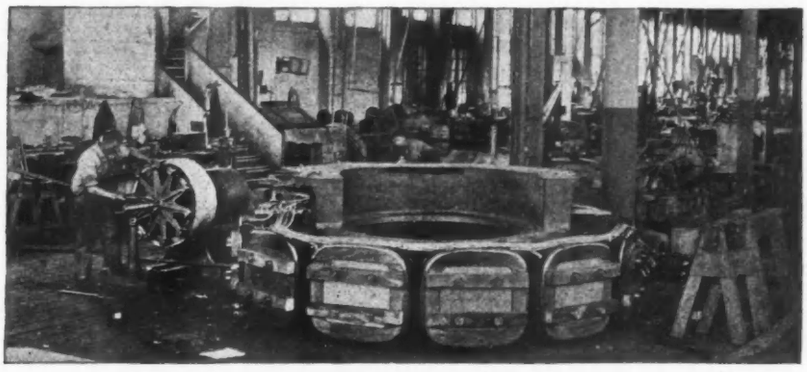

Fig. 38. FINISHED MAGNET.

"magnet caps." Wooden pieces are bolted across the radial magnet ends and boxes to keep all in place.

The completed dynamo has already been shown in Fig. 26, here reproduced.

H. L. A.

[THE END.]

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As our readers are no doubt aware, the underrunning trolley patent has been sustained by the courts. It is increasingly doubtful, however, if this decision can be made the basis of a monopoly. The Walker Company is already out with a modified trolley which is claimed not to infringe. With the standard device a lateral motion of the pole is necessary and forms part of the claim. The Walker trolley substitutes a long straight roller for the grooved trolley wheel, and thereby avoids the necessity for the lateral swing of the trolley pole. The day seems to have about passed when monopolies can be founded upon patents. Those who have any knowledge of invention and the conditions that surround patents, know that, broadly speaking, it is not the public which suffers, but the inventor, and with him the capitalist who bases business ventures upon the frail basis of patents. The cost and uncertainty of patent litigation, and the fact that some forgotten project may be a sufficient citation against a completed invention, which may have consumed thousands of dollars in being perfected, renders infringement practically safe and the inventor practically without redress. He may be all wrong, but our belief is that the public should pay the man and the corporation which have placed a valuable invention at its service, or else do without the invention.

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It is altogether possible that the greatest triumphs of electricity are to be achieved in the field of the electrolytic deposition of metals and allied industries. Electrolytic copper has already become an important factor in the market, and in other directions important results are being accomplished of which the public hears little or nothing. We have been recently told of a line of experiments now being made, which affect the very base of all chemical industry; and if as successful as appearances now promise, their results can be little short of revolutionary. Results in this field will be less spectacular than in lighting and street-car traction, but they will be no less far-reaching in their importance.

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Letters from Practical Men.

Arbor Practice.

Editor American Machinist:

The description in a recent issue of the "American Machinist" of a novel arbor for machine shop use, and the remarks accompanying it upon the general subject of arbors for turning or truing up work after it has been properly bored, at least suggest that there is still much more to be said upon this subject, notwithstanding the fact that probably few details of machine shop practice have been already more voluminously discussed. The general if not the universal practice in the use of arbors has been a barbarous one, and the barbarism mostly survives to this day. Where the barbarism has been recognized and civilizing methods have been proposed, even they have not been above criticism.

Of course, the taper arbor for the straight hole must be condemned as entirely bad; and yet it is by far the most common style in use. If you drive a taper arbor into a straight hole, trusting to the tightness of it at one end to do the driving you cannot tell to which side of the hole the other end of the arbor will crowd, and, of course, if it crowds to either side, the hole cannot run absolutely true. And if the arbor is driven in a second time, the probabilities are all against its tipping to the same side again. Who ever got a turned piece off one of those slightly tapered arbors, and then got it on again and found it absolutely true after it?

The various forms of expanding arbors have mostly been well meant. Much time and ingenuity have been spent in getting them up; but they cannot be said to have secured as good results as should have been expected. They have been made upon a false assumption. Perfection is not always best unless it can be allied with perfection. The perfectly true wheel cannot be mounted upon an untrue arbor and run true. The untrue wheel cannot be mounted upon a true arbor and still run true. It is possible, however, to mount an untrue wheel upon an untrue arbor and have the wheel run true, for one untruth may correct the other. Say that we have a perfectly true expanding arbor, and a wheel with a perfectly straight and round hole, and turn it up on that arbor, and that we have another wheel with a similar hole, and turn it up on the arbor described in the article referred to at the beginning, with the roller operating to tighten the wheel on the arbor, which of these arbors will produce the perfectly true wheel? Theoretically, the expanding arbor should produce the perfectly true wheel, and the other device evidently could not, because the tightening roller must, in tightening, draw the hole to one side, and perhaps also draw the hole out of round.

But the wheel as it is to be actually used must be tightened by some device upon its shaft, and it is notorious that all our tightening or fastening devices do their tightening by throwing the wheel out of truth. The key, of course, must be always fatal to the concentricity of anything to which it is applied, and the same is true of the set screw for tightening purposes. Now, if we take our wheel that has been turned either upon the absolutely true expanding arbor or upon the arbor with the roller tightener described, and mount it upon a shaft with a key in the ordinary way, our wheel will not be absolutely true in either case. It goes without saying that the wheel turned upon the expanding arbor, and with the hole absolutely concentric, could not be true; and it might be worse if the wheel was turned upon the other arbor, because it seems to be entirely a matter of chance as to where the roller tightener will fetch up, or in what radial direction its tension will finally be exerted. If the tension of the roller when the wheel was upon the arbor, and of the key when upon the shaft, should happen to come at the same radial line, the result might be a happy one; but if they should happen to come opposite each other, the eccentricity of the turning would be doubled in the running upon the shaft.

The expanding arbor has its uses, and it is not to be spoken of lightly; but it cannot be considered to offer a general solution of the arbor problem. The range of expansion for each size of arbor is small, or should be so; and besides being individually expensive, it is still more so for any extensive range of work, and for larger sizes it is in every way impractica-

ble. No shop could be stocked with expanding arbors exclusively, and depend upon them for the entire range of its work.

The way out of the trouble is the direct and common-sense way, even if it is the way that has heretofore been used the least of any. Common sense is too often the device of the last resort, instead of being first of all employed. Let the wheel, or whatever it is that we have to turn, be held upon the arbor just as it is to be held upon the shaft where it is permanently to run. If the wheel is to be keyed upon a shaft, let it also be keyed upon the arbor, where the turning, or at least the final turning, of it is to be done. The key-seating should immediately follow the boring, instead of being, as it now usually is, the last job of machine work. This, of course, will apparently call for a key-seat in the arbor, and in fact there is really no other logical way out of it. If the wheel is to be secured by set screws, they should be in the wheel before it is turned, and they should be tightened in the arbor. The screws might always be screwed down upon the same side of the arbor, but here trouble might soon arise, as the points of the screws would be likely to stretch the metal on that side of the arbor and throw it out of truth.

It is to be hoped that we will some day come to a more general adoption of the plan of splitting one side of the hub and using bolts to draw up that side, and in that way clamp our wheel or pulley hubs to our shafting. In that case our trouble about arbors at once disappears. Perfectly straight arbors of the same size as the permanent shaft, and with the hub tightened upon it in the same way that it is to be tightened upon the shaft, must produce perfection of work. The necessary working conditions for good arbors need not be mentioned. It would be best to have them of steel as hard as can be conveniently turned, with large and perfect centers and good square ends. The lathe centers, of course, should always also be right. Nothing should occur in shop practice to mutilate the ends of the arbors. Whenever it is necessary to drive an arbor into a hole, it is also necessary to remember that our practice is necessarily wrong, at least theoretically. I do not say that we will ever be able to get along without indulging in the practice to some extent, but it is always well to keep in view the conditions that seem to promise the nearest approach to perfection.

CYRUS T. BROWN.

St. Louis, Mo.

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Charging a Cupola.

Editor American Machinist:

In reading the letters of Mr. Grindrod and Mr. Green, the thought came to my mind that I could add a little to the good cause by telling how I work my cupola.

I am in charge of the Hercules Ice Machine Company's foundry at Aurora, Ill. I have two cupolas—a 42-inch and a 60-inch. We make very heavy castings; also some very light ones. My heats run, for the 42-inch cupola, from 4 to 16 tons, and for the 60-inch from 18 to 40 tons. In putting in my sandbed for the 42-inch cupola, I add enough sand so that I will have about 12 inches between the bottom of my tuyere and top of sandbed. The wood should take up about 24 inches from the sandbed. I then charge on my coke to about 42 inches above the wood, making in all 66 inches. This will make a coke-bed of about 600 to 700 pounds (Connellsville 72-hour coke), and bring the coke, after the wood is burnt out, to from 18 inches to 24 inches above the tuyere. Letting my coke-bed burn to a bright cherry-red, I then charge on 2,000 pounds of iron; then, for all after charges, 150 pounds of coke and 1,000 pounds of iron throughout the heat, dropping off the coke on the last one or two charges.

In case I am using heavy scrap or all pig iron, which is often the case, if it is a wet murky day I add more coke or reduce my iron charges. Iron will melt much faster, but not as hot, and the test bars will not show as much strength on such a day.

In using my 60-inch cupola I adopt the same rules as used on the 42-inch cupola, bringing my coke-bed to 24 inches above tuyeres—4,000 pounds iron on first charge, 2,000 pounds on all other charges, and 200 pounds of coke to each 2,000 pounds of iron. A 16-tine coke fork will take seven forkfuls to make 100 pounds Connellsville coke.

Mr. Grindrod and Mr. Green will understand, as well as all other foundrymen, that iron melting in New Jersey, Montana and Illinois are three different things, as it has been proven that climate affects cupola practice in all localities where there is a radical difference.

Mr. Grindrod had better be more careful in sending out figures for publication that are incorrect, or his thirty years' experience will not amount to much. We think that melting 7 or 8 pounds of iron with 1 pound of coke is good work the world over. But Mr. Grindrod's figures show to me the fact that he melted scarcely any iron, for the simple reason that after charging on the coke his figures called for, there was not room enough in the cupola for much iron. Davy Crockett used to say: "Be sure your're right; then go ahead," and I should advise Mr. Grindrod to adopt that motto.

As to using judgment in cupola work, I think it requires some judgment to even drive a nail through a board.

B. F. CHAMBERS.

Aurora, Ill.

[We trust that our correspondent will pardon us for remarking that we do not quite understand even his arithmetic. In the 42-inch cupola the alternate charges are 150 pounds of coke and 1,000 pounds of iron, or less than 7 to 1; while in the 60-inch cupola the charges are 200 pounds of coke to 2,000 pounds of iron, or 10 to 1. It looks almost as if the coke charge for the 60-inch was as the direct diameter, while the iron charge was as the square of the diameter when compared with the 42-inch cupola.—Ed.]

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Editor American Machinist:

In answer to the just criticisms on my letter of May 21st, I wish to say that I made a great blunder when I said that the capacities of cupolas were in proportion to their diameters; still, if anyone had tried the rule as I gave it, they would not have lost anything unless they had changed to a cupola of large diameter, when I think it would have proved disastrous to the heat. I have followed the same rule for the past ten years and have never lost a heat; I have used it on a 30, 36, 40 and 42-inch, but I don't now claim that it is what I thought it was. I supposed it was all right, as it worked successfully with me.

There was an error in saying 15 inches from iron bottom, when it ought to read 15 inches from sand bottom to bottom of tuyere. Measuring from iron bottom has no meaning in regard to charging a cupola, for the sand bottom might be put in 3 inches, 6 inches or 1 foot thick, which would change the bed of coke considerably.

I feel confident we can find a rule that can be relied on. I have tried the 30-inch, so that I do not think for taking off a good-sized heat there could be any more fuel saved and have good iron.

E. GRINDROD.

Helena, Mont.

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Twist Drills with Tubes for Lubricant.

Editor American Machinist:

The special twist drill made by the Cleveland Twist Drill Co., and illustrated in your issue of July 16th, "fills a long-felt want," and obviously fills it well.

Many attempts have been made to accomplish this result with home-made drills on the hog-nose principle and having a hollow shank for the discharge of the chips, and some people claim to have been successful with them. That excellent mechanic whom we all respect so highly—Mr. A. B. Landis—published a full description of such a rig in your columns some years ago. Having a good deal of deep boring in machinery steel to do, I attempted to apply his method, but after long trial was forced to give it up, beaten. The difficulty was the constant tendency of the drill to seize the stock being drilled, owing to the heavy side pressure of the tool against the hole. How others succeed, or wherein I failed to do what was necessary to success, I have never been able to learn, but give it up I had to. One

thing I did learn, however, and to tell it is the immediate purpose of this letter and quite in line with what has recently appeared in your columns, namely, that high speed is the key to fast work with such tools. With ordinary speeds it was a case of flat failure from the start, but with high speeds we made the thing go, though not well enough to continue the use of the plan.

What we finally came to was a common (though well-made) flat drill fitted with an oil tube. Before hardening the tool we drilled two rows of small holes down the center line, by which we wired a small brass tube to the drill and carried the oil to the point. This rig is entirely successful, and with it the high speeds have been continued to great advantage, and while, of course, it is not to be compared with the elegant tool which you show, it has demonstrated to me the value of high speed. We have a great many holes from about ⅞ inch to 1⅛ inch diameter to make in machinery steel, and for these we use a speed of about 150 turns per minute, the drilling being done in a turret lathe. The secret of this speed is, of course, the fact that the flood of lubricant keeps the tool from heating.

I have no doubt that the tool which you show will find large use as it becomes known, and think the advantage of high speed with it should be made known, as the tendency with it will naturally be to use about the same speeds as in ordinary work, thereby accomplishing far less than what the tool is capable of.

SUPERINTENDENT.

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Slide-Rule Practice.

Editor American Machinist:

In fulfillment of my previous threat of giving you some points upon the slide rule which have occurred to me in my own practice with it, I would say that, as far as multiplication, division and proportion, or "rule of three," are concerned, the entire practical utility of the instrument may be briefly set forth by the statement that, in whatever position the slide may be placed, the figures on rule and slide stand over each other in equal ratios. That is to say, any number on A divided by the number directly under it on B is equal to any other number on A divided by the number on B directly under it, and the same is true of C and D. Thus, in Fig. 9 (June 25th) we have on A and B:

$$\frac{2}{3} = \frac{3}{4.5} = \frac{72}{108} = \frac{9.73}{14.59}, \text{ etc.}$$

Hence, if we have any calculation in the form of $\frac{a\,b}{c} = x$, we write it thus:

$$\frac{a}{c} = \frac{x}{b}$$

That is, we place one factor on A or C over the divisor on B or D, and over the other factor we read the answer x. It is immaterial which factor we place over the divisor; but by chosing the one nearest in value to the divisor, or the one which may happen to be a readily recognized multiple of it, we facilitate the determination of the number of places of figures in the answer.

Multiplication is only a special case of the above; for if we have $a\,b = x$ we may write it in the form:

$$\frac{a}{1} = \frac{x}{b}.$$

That is, set one factor over 1, and over the other read the answer. If, when using the two top scales, we always draw the slide to the left and use the central 1 of B as the index, setting it under one factor and taking the other factor on B to the right of center, then, if the answer is found to the *right* of the center on A, it will contain as many places of integers as the sum of those in the two factors; if to the left, one less. Thus, in Fig. 9 the index stands, say, under 6,650. If we wish to multiply that number by 225 we take this factor to the right on B and find the answer in the figure to be 1,500,000, because it is to the right of center on A. It would be closer on an actual slide rule to the correct answer. If we multiply by 1.20 the answer is, by the figure, 8,000. To multiply decimals with ciphers to the right of the decimal point, consider them as whole numbers and then point off as in ordinary multiplication.

Division is also a special case of the above property of the slide rule. Thus, if we have $\frac{a}{b} = x$, we write it:

$$\frac{a}{b} = \frac{x}{1}.$$

That is, we place the dividend over the divisor and find quotient over 1. If we always draw the slide to the left and take the denominator to the right of the center on B, then we can devise special rules for the number of places of whole numbers or decimals in the answer, according as the numerator falls to the right or the left of the center on A. But there are many complications, particularly when there are ciphers to the right of the decimal points, and inspection is the best guide. If there are decimal ciphers in the denominator, multiply them out. Thus, to divide 0.000002 by 0.003, write:

$$\frac{0.002}{3}.$$

The answer 0.00067 then becomes self-evident.

In the rule which I use myself, made by or for Mr. R. C. Smith, consulting engineer of the Otis Elevator Co., the above operations are done on the two lower scales, and the slide is drawn to the right. But the principle is the same. One reason why people are often discouraged in using the slide rule is probably because the slide usually works very hard. I find the best way to ease a new rule is to take a pocket whet-stone and carefully rub down the sticking points, using the stone dry, of course.

Yonkers, N. Y. E. S. G.

The Microscope as a Center Indicator.

Editor American Machinist:

There were several articles published in your paper four or five years ago, describing a remarkably accurate job of locating holes, part of the work being done by Mr. Geo. W. Bowers. This gentleman's account of his method of procedure mentions an indicator that is especially sensitive, and "also constructed so that it cannot injure the laid-out centers." You gave Mr. Bowers a hint at the time that a description of his indicator would be fully as interesting as were the details of the laying-out job, and I have meanwhile been patiently waiting for the same to appear; but in this particular case it was the expected that didn't happen.

Lately, however, I have struck a scheme by which work can be accurately located on a lathe face plate by an indicator that does not touch the work at all, and I think I can go Mr. Bowers one better, as I can get along without the fine center punch that he drops into his intersecting lines by the sense of touch.

The method I used was to place a small compound microscope in the slide rest with the tube approximately parallel with the

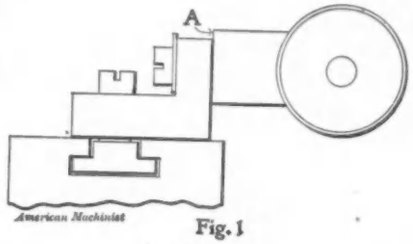


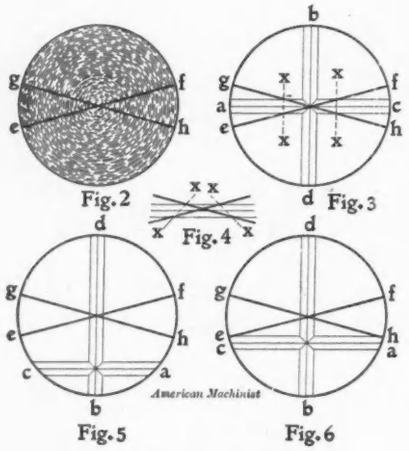
Fig. 1

lathe bed, and pointed towards the work that was loosely clamped on face plate. The microscope was fastened to a small angle piece that was bolted to tool-post T-slot (Fig. 1), the feed screw that was parallel to lathe bed being used as a focusing adjustment. The joint at *A* was a stiff friction, so by rocking the microscope on this pivot a slight vertical movement could be given to the objective end of it. Of course, if used on a lathe with a rise and fall rest, this friction joint would not be necessary, as then the elevating screw could be used to give the vertical adjustment. By means of this vertical movement, and the horizontal movement by cross-feed screw, it is an easy matter to get the intersection of the spider lines in the eye-piece of the microscope to coincide with the center line of the live spindle, as in Fig. 2, by adjusting the spider lines on that spot that appears to stand still when the lathe is rotated at a moderate speed. Then the lathe can be stopped, and the work shifted on the face plate till the intersection of the two marks coincides with the intersection of the two spider lines, as in Fig. 3.

The two marks *a c* and *b d* on the work, I have drawn as V-shaped grooves, which is what they look like when viewed with a

magnifying power of about 180 diameters, only the bottom of the V is not perfectly sharp, nor are the edges of the V perfectly smooth where they join the surface of the work, but are more or less ragged.

A still greater degree of accuracy may be obtained by using the method just described to get the work located pretty near right; then turn the face plate till the spider lines *e f* and *g h* are equally inclined to the line *d c*, and adjust the microscope so that the intersection of *e f* and *g h* coincides with the bottom of the groove *a c*. As it is rather difficult to tell just where the bottom of this groove is, it helps matters somewhat to make a mental note of where the spider lines cross the edges of the groove, and then conceive lines *x x*, *x x* drawn through these points; if each of the lines *x x* is at right angles to the groove *a c* (as near as can be judged), then it is safe to assume that the intersection of *e f* and *g h* coincides with bottom of groove. The effect of the intersection being slightly to one side of the bottom of groove is shown at Fig. 4, where the lines



x x are very much inclined to *a c*. That is the reason for the spider lines making such a sharp angle with one another, instead of being at right angles, as they are in a transit or leveling instrument. After having carefully adjusted things as shown in Fig. 3, give the face plate a half turn, when, if the work is not truly centered, *a c* will fall either below or above its former position. We will suppose it falls below, as shown in Fig. 5: The true center line of the live spindle is now half way between the groove *a c* and the intersection of *e f* and *g h*, so if we shift the work half way to the spider lines, as shown in Fig. 6, and then shift the microscope the other half to meet the work, they will then both coincide with center line of spindle, provided half the apparent error has been correctly estimated. By repeating this process, the error can be made smaller and smaller until it finally disappears. It is well to operate first on *a c*, then on *b d*, then on *a c* again, and so on alternately, as when we are centering one line we are apt to slightly alter the position of the other one, particularly if much movement has to take place.

As the microscope reverses the position of things, the work in Fig. 5 appears too low on the face plate, but is in reality too high, so by gently striking the work on top with a mallet to move it down it will appear to gradually move up to the position shown in Fig. 6. By always using the mallet on top of the work, the mallet and gravity act in the same direction, and we are a little more sure the work is going in the direction we want it to.

Of course, the higher the magnifying power of the microscope, the more sensitive it is as an indicator; but the use of high powers is attended with certain inconveniences. The area that we can see at one time decreases as the magnifying power increases, a circular spot 1-32 inch in diameter being about all we can see of the work when using a power of 180. Another point is that the apparent brightness of the object diminishes as the magnifying power increases, so with high powers artificial illumination has to be resorted to. High powers are usually obtained by using short focus objectives; but these have to be brought so near to the work as to seriously interfere with its illumination, besides costing considerably more than those of longer focus. The power may be increased by lengthening the tube of microscope, but this in turn makes it rather cumbersome. Perhaps in this, as in many other cases, the best results would be reached, not by going to extremes, but by choosing a middle ground in the matter of tube length, focal length of objective and power of eye-piece.

This description, being somewhat long, might convey the idea that the process is rather a slow one; but, as a matter of fact, work can be trued up as quickly with a microscope as with the usual style of indicator, after the operator has become familiar with it.

Some men strike a "safety circle" on the work to tell if it moves while roughing out the hole, and the microscope is a first-class thing to gaze at this safety circle with, to see if it still runs true.

WALTER GRIBBEN.

▲ ▲ ▲

At Liverpool, Eng., they are trying a novel experiment in supplying hot water from or in connection with street lamps. A syndicate has permission to experiment with three lamp-posts for three months. The heat from the gas flame is utilized, and the hot water is sold at a cent a gallon. In Paris, hot water has long been retailed in the streets, but not from the lamps. If successful, this will help gas in its fight against electricity.

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The glass industry in Norway is steadily declining, notwithstanding the low prices of materials and coal. In 1890 the exports of glass were valued at $157,880, and in 1894 the value was $106,420.

A Swedish Cutter Grinder.

We have received from Köpings Mekaniska Verkstads Aktiebolag, of Koping, Sweden, a catalog and some photographs of a tool grinder which will not be without interest to our readers. We give a general view of the machine and some views showing the method of grinding.

The machine is provided with two emery-wheel spindles, either of which can be used according to circumstances, and the former principle is made use of; that is to say, a template the shape of the required cutter is made of sheet steel and clamped to the same fixture on which the cutter is held, and this template, by being kept against a guide screw, or a disk, determines the form of the cutter. By this means cutters need be only approximately formed in the lathe, the shape of the template is sure to be reproduced whenever

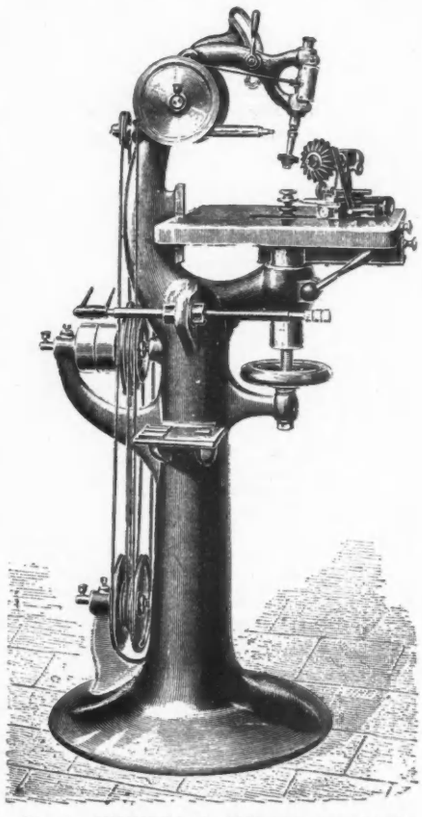

Fig. 1 UNIVERSAL CUTTER, REAMER AND TOOL-GRINDING MACHINE

the cutter is ground, and it will have uniform clearance. The general view of the machine makes its construction clear, and it will be seen that clearance, when using the horizontal spindle, is secured by adjusting the table vertically, while the angular adjustment of the upper spindle gives the required clearance there.

Taking first Fig. 2, we see how things are arranged for grinding an ordinary angular cutter. A place is provided for clamping the template as shown, and by then adjusting the guide screw and the slide upon which the cutter is mounted, the desired amount to grind off is secured. This slide is shown better in Fig. 4, and it will be

noticed that it is so arranged that the cutter can be moved to or from the wheel for adjustment of cut without moving the template.

At Fig. 3 is shown the same arrangement, except that the template is for a gear cutter, and gear cutters thus made may have any desired number of teeth and the same degree of clearance all around.

The makers of the machine state that, when using the horizontal spindle, the wheel must be thinner, but need not be the same shape as the end of the guide screw. We do not understand how this can be so, however, as, so far as we can

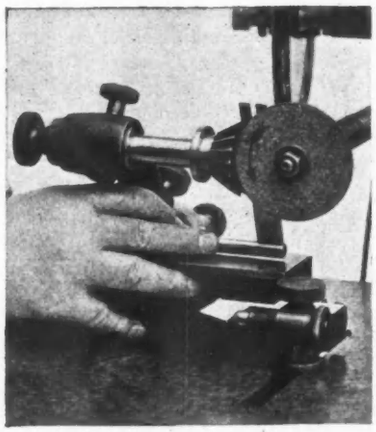

Fig. 2. GRINDING AN ANGULAR CUTTER.

see, it would be important that the periphery of the grinding wheel should be precisely the same shape as the end of the screw. However, they recommend wheels not more than 2 or 3 millimeters ($\frac{5}{64}$ inch to $\frac{1}{8}$ inch thick), and a very little rounding of the corners on such a wheel would give close enough approximation to the true form for most purposes.

At Fig. 4 is shown the method of grind-

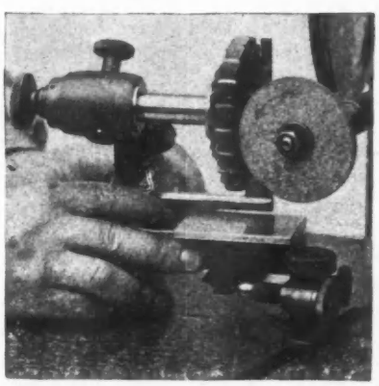

Fig. 3. GRINDING A CUTTER.

ing forming cutters, the one shown being for forming handles.

At Fig. 5 the upper spindle is shown in use for grinding a form cutter. Here a disk is used in place of the guide screw, and this disk must obviously be of the same diameter as the wheel. The makers state, however, that the disk must be larger than the wheel, though they do not say how much larger. We should think also that the disk would need to be inclined to the same angle as that of the wheel, in order to get strictly accurate results.

Fig. 6 shows the reamer-grinding at-

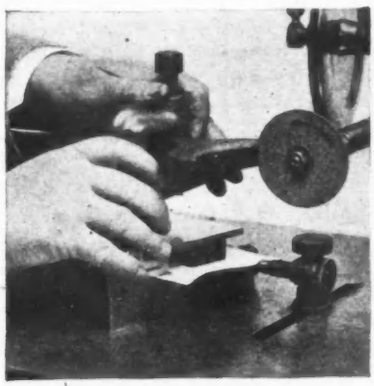

Fig. 4. GRINDING A FORMING TOOL.

tachment by which reamers may be ground straight or taper, and with spiral flutes if desired.

We have shown only a few of the many

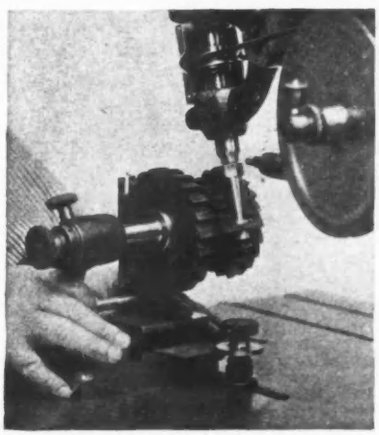

Fig. 5. GRINDING A FORMER CUTTER.

varieties of tools that can be ground by the machine, and it is evident that there is scarcely a limit to its applicability; and since the entire fixture upon which the

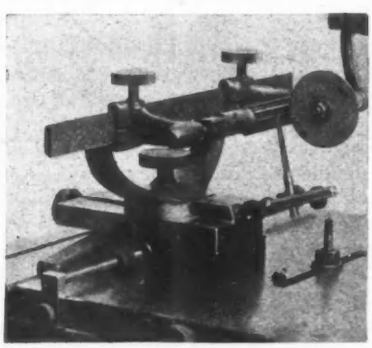

Fig. 6. GRINDING A REAMER.

cutter is mounted is only laid upon the table, it can be picked up at any stage of the grinding to examine or gage the cutter.

Metrological Standards and Gaging Implements.

(Concluded from last week)

"When finally we were prepared to adjust gaging implements there arose another impediment, more formidable still. The contact points of the calipers with flat faces could not be ground parallel. The grinding wheels have to rotate parallel to these faces, and pass over them, and as the pressure is as the area in contact, the unavoidable elasticity in the wheels and their mountings, produced a curved surface. Here was an inherent principle involved—an insuperable difficulty that seemed to set at defiance all known methods of manipulation.

"I remembered then Prof. Sweet's significant remark, and we applied to him for information. It was as expected. This was the difficulty he had met with. He kindly came to Philadelphia to aid us with his own experience and suggestions, but there seemed no way out of this dilemma until one day light came from an unexpected quarter.

"Mr. J. Morton Poole, Sr., of Messrs. Poole & Sons, Wilmington, Del., came into the works to examine the gage-making process. At this time I imagine that no one in the world had given so much attention to abrasive grinding as Mr. Poole. He had a laboratory for experiments and the making of grinding wheels. He had collected corundum and other abrasive minerals from all parts of the world, and had an organized and classified cabinet of such minerals. We thought then, and I believe yet, that in that laboratory was collected more knowledge of abrasive grinding material and processes than existed among all the makers of grinding wheels in this country, or in the world perhaps. Some of his grinding operations on paper calendering rollers were marvelous, and so intricate as to almost defy explanation. He would grind piles of these rollers eleven in height so as to exclude light between them, and the line of light, as it is called, is commonly estimated at the ten thousandth part of an inch. The guidance to produce this marvelous parallelism and truth was derived from what may be called theoretical axis of rotation, and not from mechanical guides or ways.

"Mr. Poole heard patiently an account of our dilemma, and then quietly remarked: 'You must grind without pressure; come to Wilmington, and I will show you how to do this.'

"He had by the selection of certain fine grades of sharp corundum, and by certain methods of cementing, produced wheels that when flooded with a solvent of this cementing material would grind without pressure. I do not now remember the composition, and if I did would not feel at liberty to make it known even at this time.

Continued on page 17.

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"Productive" and "Non-Productive" Labor in the Shop.

The terms "productive" and "non-productive," as applied to the men employed in an industrial establishment, are generally unfair. The latter term is always more or less libelous, and the customary use of this classification cannot fail to be more or less misleading in our estimates of the relative value and importance of the different individuals. The terms seem to be based upon a false assumption. If a farmer set out to raise a crop of grain, he probably would not divide his labor in this way. He would not call the sowing of the seed "non-productive" labor, and only the reaping as "productive." If he were a farmer of advanced ideas, he would probably not consider even the study of the rotation of crops and the constituents of fertilizers as "non-productive" labor.

The business of any manufacturing establishment is to produce a certain line of product in quantity and quality that shall prove remunerative. No such result can be secured by the making of chips alone, although we may have got into the habit of calling only the chip maker's work "productive." The term "productive" is one of commendation, and "non-productive" is one of reproach. We want as much of the first and as little of the last as possible. Under such a theory, the ideal establishment would employ the former exclusively.

The man who runs the bolt cutter and he at the upright drill are producers, while the draftsman upstairs is a non-producer. What the draftsman has to show as the result of his labors cannot be sold, and he therefore is a non-producer.

It is probable that the draftsman has suffered more than any other from this classification. Men do not get what they are worth, but what they are thought to be worth. They may sometimes be thought to be worth more than they are, but too often it is the other way. The draftsman is as likely to be an inadequately appreciated individual as anyone that can be found. The suggesters of ideas in these days too often pose as inventors, and the actual designer of the completed and successful machine, the tedious steps of computation, and the unending trials of arrangement, are all ignored.

The same appreciation often rules in the shop. A draftsman is a draftsman and a drawing is a drawing; that one may be better than another does not seem to be thought of. And yet correctness and reliability are the most valuable traits that a draftsman can possess, and as those are enhanced his value should rapidly advance, and his appreciation and remuneration along with it.

Under our system of sorting out our labor as "productive" and "non-productive," it is possible for absurd things to occur. We might have a case, not uncommon, where, regarding merely the workmen in the shop and the draftsman as the producers of a certain machine, the relative costs of the chip-maker's and of the paper-marker's labor might be 50 for the former and 3 for the latter. Of course, the 3 is "non-productive" labor, and if it could be reduced to 2 that would be a great gain. After we have made the reduction to 2, we may find that our 50 for labor, by reason of less perfectly thought-out design, or by actual discrepancies of measurement, and the consequent doing of work over again, has risen to 75; and yet there are so-called systems of shop management under which it would be possible and proper to regard the latter arrangement with approval, for the "non-productive" labor would then be only 2⅔ per cent. of the "productive" labor, while in the first case the draftsman's "non-productive" labor was 6 per cent., or over double as much in comparison with the "productive" labor.

The fact is that all necessary or economically advantageous work done about a machinery-building establishment is "productive" labor and should be so regarded, and not as a "necessary evil."

The Danger of Two Thousand Pounds Air Pressure.

The use of compressed air for street-car propulsion is being industriously deprecated in some quarters in advance of its employment. It is hardly time yet for anyone to be much frightened on this score. It is at least best for the general peace of mind of the community that only real sources of alarm should be drawn from, and this is not one. If compressed air is to fail, it will not be on account of the disastrous explosions that occur in connection with it.

It may be safely asserted that, under any conditions that are likely to prevail, a steam boiler with one hundred pounds of steam is vastly more dangerous than a receiver of compressed air charged to a pressure of two thousand pounds. No one now thinks of a locomotive as being always ready to blow up, and, indeed, quite likely to do so without a moment's warning, although one has occasionally scattered ruin and destruction around; and so it is quite possible that we may yet be able to pat the side of the charged air receiver with approval and confidence.

Whatever danger there may be in connection with compressed air of high pressure must be in the receiver alone, and in the chance of its sudden explosion. The giving-out of a pipe or connection could never entail any serious consequences. There would be no scalding steam or hot water to escape. We all know the terror of these, and air is absolutely innocent and harmless where steam if released would scatter wholesale destruction. As to the receiver itself, we know that, in the nature of the case, every receiver must have been tested, and with a large margin of safety, before it is put to use. About steam boilers we only know that, notwithstanding all the inspection laws, some boilers have some time been tested, while most boilers never have been, and under present practice never will be tested for pressure.

The most dangerous time for the compressed air receiver must be at the moment when the pressure is greatest, and this must be when a charging or a recharging has just been completed. From that moment, as the air is used and the pressure falls, the danger point rapidly recedes and disappears. But who shall say when or where is the greatest danger with the steam boiler? The danger with it is always present, and may at any moment be increased beyond endurance. The boiler carries unlimited possibilities of future danger, while the danger with the air receiver is always retrogressive.

But the one essential thing to be remembered in connection with the air receiver is that it does not contain the reserve force that a steam boiler carries in its body of hot water. When the air receiver explodes, the result produced is limited to what the volume of air alone

can do, and there is nothing behind the air to follow it up and add to its work of destruction. With the steam boiler the volume of steam contained is only a portion of the destructive agency that may be released. When a steam explosion occurs there is not merely the boilerful of steam, but much more steam chained in the water, and immediately released and pushing on what goes before. A common form of steam boiler explosion has been the blowing-out of the head of a long horizontal boiler, when immediately the body of the boiler is transformed into a sky-rocket, the steam and water streaming out of it and driving it onward with terrific speed and force. Notwithstanding the great area of discharge, a considerable pressure of steam is maintained for an appreciable period of time by the heat contained in the body of water. It is needless to say that if a head should blow out of an air receiver, nothing comparable with this could occur. The reduction of pressure would be instantaneous, and there would be nothing to maintain the pressure but the volume of air itself. Whatever may be the form of rupture that may occur to the retaining vessel, it means immediate release to the air; while with the combined steam and water there is an accumulated store of force to follow up and tear things still more.

There may yet develop practical objections fatal to the general employment of compressed air for street-car propulsion, although we have as yet no hint of the existence of such features; but whatever the objections may be, we certainly need not regard the danger element as one of them. In fact, the safety of the air system must always be one of its chief recommendations.

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In the eyes of the cabal or line clique which is running naval affairs no crime is quite so heinous as letting outsiders know anything of what is going on in the Navy. The members of this clique pretend to believe that, no matter what abuses may have sprung up, nor how much the efficiency of the Navy may have been impaired by these abuses, Congress and the people who pay the bills should know nothing of them, and engineers should appeal only to those who are themselves responsible for the abuses and who think their interests demand the continuance of them, *i. e.*, the members of the clique themselves. The people of the country are not likely to agree with this view of the matter, however.

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The Treasury Department, through Supervising Inspector-General Dumont, of the Steamboat Inspection Service, has issued an order regarding life-boats and rafts, and amongst other things required is that every life-raft or boat "shall have permanently attached thereto a metallic plate having thereon, in raised letters and figures, the name of the maker of the raft or boat, the place where manufactured, the shop number, and date of manufacture; and if built of metal, the thickness thereof, *Birmingham gage*." This seems somewhat strange in view of the fact that Congress not long ago passed a law legalizing a gage for sheet metal which is not the Birmingham at all. One would naturally think that a gage good enough to be imposed by law upon the general public would be good enough for a Government official to use.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(134) Inquirer, Waltham, Mass., asks for a method of preventing condensing engines from racing when the load is thrown off. A.—At the power house of the Lenox avenue line of the Metropolitan Traction Co., of this city, we recently saw a provision for this difficulty, which consisted of a special stop valve held open by a catch. A special governor, arranged to lift at a speed slightly above normal, controlled this catch. On the speed rising to a point to raise the governor, the catch is released and the valve closes itself. A method followed by Hewes & Phillips is to set the steam valves with no lead, or with negative lead, and then adjust the cut-off cams so they will trip the valves before the engine takes steam.

(135) T. A. W. asks: What difference, if any, should be made in the design or construction of a small engine, say 10 horse-power, to run by compressed air, instead of by steam, at the same pressure? A.—There would be practically no difference. We have known common steam engines run quite satisfactorily by compressed air, and hoisting engines are used in mining plants that are run by either compressed air or by steam indifferently, as may be most convenient. If the air is to be used economically the engine should, of course, have a cut-off, and for the same pressure the theoretical cut-off for air should be later than for steam. An automatic cut-off would, however, take care of itself in either case. At 80 pounds gage pressure, steam cut off at .2 stroke would give very nearly the same terminal pressure, a little above one atmosphere, as air cut off at .3 of the stroke, although the mean effective pressure in this case would be higher for the air than for the steam. If the engine is to be run steadily, a reheater should be employed for the air. It would increase the ultimate efficiency of the air more than a condenser does for steam, and it would also avert all danger of choking the exhaust by frost.

(136) Constant Reader, Buffalo, N. Y., asks: If a student were to take a special course in an engineering school, comprising algebra, geometry, trigonometry and analytical geometry, with laboratory work, drawing and designing, but omitting calculus, would he not be qualified as an engineer nearly as well as one who took the entire course? A.—Few machine designers make much direct use of the higher branches of mathematics named. They are of value chiefly as preliminaries. Next to the mechanical sense, the foundation stone of a mechanical engineer's equipment is a knowledge of analytical mechanics. It is this which gives one a grasp of fundamental principles, and of the action of forces under all conditions. The higher mathematics named are chiefly of value as a preparation for this study, and without it we should consider them of limited importance. This is especially true as regards calculus. Very few engineers make any use of this branch of mathematics in everyday work; but as most of the engineering courses are laid out, it would be impossible to take up analytical mechanics without having first taken the work in calculus. We have answered the question in a broad way as it is asked. Of course, a great amount of the most creditable and valuable work is done and will continue to be done by those who have little or no formal knowledge of the branches named. Pocket books and reference books place at the disposal of anyone the results of mathematical investigations, and with their aid, and in the hands of those of proper natural qualifications (which, at bottom, are more important than any educational acquirements), work of a high order is everywhere being done; but this does not alter the fact that in a full engineering course analytical mechanics is the most important single study.

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Business Specials.

Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Works removed to Boston—See p. 26.

1896 Catalog just out. Boston Gear Works.

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Milling Machs. Kempsmith Co., Milwaukee, Wis.

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Metrological Standards and Gaging Implements.

(Continued from page 15.)

"The theory, as explained by Mr. Poole, was this: 'a new sharp edge does not repel, on the contrary will draw the material to the edge. Now, each time one of my wheels turns around a new set of edges are brought to bear, because the wheels are slowly but continually being dissolved by the liquid solution in which they run, or with which they are flooded.'

"The result was remarkable, and will also seem incredible. If a file was laid in front of one of these wheels, pivoted at its center so as to swing against the wheel, and a jet of the solvent solution was turned on, the file when swung against the wheel would remain there, and be ground away without any extraneous

pressure whatever. This may arise from the effect produced by the liquid, or other cause than the extreme sharpness of the abrasive edges. I do not claim to understand the phenomena, and we were too gratified at the results to press for explanations from Mr. Poole. He prepared wheels suitable for grinding the points of calipers, a thing he had never done before for any one, and extended many courtesies and kind acts that will never be forgotten.

"The problem of making fixed calipers was solved, and gage-making rendered possible; first, by Prof. John E. Sweet, who discovered and pointed out the nature of the difficulty in grinding the contact points, and by J. Morton Poole, who removed this difficulty by his knowledge of abrasive processes, and it affords me pleasure to present these facts again, nearly twenty years after their occurrence.

"As soon as accurate calipers could be ground, orders were taken and the business began, one of the first orders being for a railway works in England, and the second for the Baldwin Locomotive Works, at Philadelphia. It was sixteen years from the time of making the first set of calipers at Columbus, O., and $18,000 had been spent in implements, experiments and other expenses.

"After the business was founded, some other firms at the East took it up, and added what Mr. Taylor called the 'theatrical part.' The Whitworth system of end contact or touch, as it may be called, was disparaged, and apparatus for visual divisions was instituted. So eminent a mechanic as Prof. Rogers, of Cambridge University, went so far as to forget the courtesy due to Sir Joseph Whitworth and to deride his 'millionth measuring machine.'

"Sir Joseph Whitworth had made in his works a machine fitted with such accuracy that it would indicate to one millionth part of an inch, a thing easily proved and performed hundreds of times, but it was not a measuring machine in the sense of testing or defining dimensions.

"I know more of this machine, which I have often seen, than it was possible for Prof. Rogers to learn then or now. It was made mainly by Mr. John Sincock, now of Birmingham, who was for many years in the works of Sir Joseph Whitworth, engaged in the gage-making department, and who has informed me of the methods of attaining the extraordinary fitting done on this plain-looking machine.

"A small bar of metal was poised like a scale beam to vibrate between the contact points of the machine. This bar was set in vibration and the points closed until the friction between them would cause the vibrations to cease. Then the pivots were drawn back, the beam set in vibration and the points returned to within one millionth of an inch of their former position and the beam again set in vibration, which would continue until the points were advanced a millionth part of an inch, when the friction would arrest vibration. The machine is in the Kensington Museum, at London, and is no doubt capable of the same demonstration now. The purpose of the machine, and its only purpose, was to show that surfaces can be so accurately fitted as not to move in stages when such minute adjustment is made.

"The standard machine at the American Standard Gage Works, that weighs about 600 pounds, and has a range of six inches, is fully sensitive to the fifty thousandth part of an inch, as was demonstrated before the Franklin Institute in 1879, when I read the paper before referred to, illustrated by various implements and machines supplied from the gage works in Philadelphia.

"The machine is set on balance beams, a necessity discovered in its adjustment. It is covered with a close glazed case, and set where the sun will not shine upon it. This latter matter caused some difficulty during adjustment. The contact points are double, and it was discovered that during the forenoon the rear points facing southeast were loose, and front points were closer. In the afternoon they resumed their normal relation. This was caused by the sun shining through a window at the back of the machine, and is not a matter of wonder at all.

"It is a common supposition that the processes of gage-making require great dexterity and skill, because of the minute dimensions dealt with, but in a gage works there is no more care or concern respecting a ten thousandth of an inch than there is over one hundredth of an inch in common fitting. Workmen deal with these small quantities in the most commonplace manner, by numerals which represent thousandths of an inch or tenths of thousandths, these being the units employed for all kinds of work. * * *

"Nearly all finishing operations in gage-making are performed by succession so as to avoid a rise or change of temperature. If calipers are to be ground, from five to twenty-five are taken at one time, and after a few passes in the grinding machines one is removed and another inserted until a close limit of accuracy is attained. Then the whole are tested by the standards. Each piece after testing is marked with chalk, 2—3—4, and so on, these figures meaning tenths of thousandths of variation from the standards. Those coming within one five thousandth of an inch were taken out as one class and the rest returned to the grinding room.

"By repeated trials the accuracy would increase, and a second class within one ten thousandth of an inch would be taken out as completed. A still higher class had a limit of one twenty-five thousandth part of an inch. This was the ultimate accuracy aimed at in commercial implements. These latter were sold at a much higher price, and were seldom wanted. The expense of adjustment increases very rapidly with the precision attained, much faster indeed than the difference in price, and gages beyond the limit of one ten thousandth of an inch were not very profitable to make.

"You will no doubt wonder how such implements can be removed from a machine and be replaced again so as to have precisely the same position, but this is simple enough. Everything ground is mounted on centers or points like those of a lathe, but very carefully prepared and the center points accurate and kept clean. The centering points are cut away from the gages.

"The first use of gaging implements in a systematic way was no doubt by John G. Bodmer, at Manchester, England. Mr. Bodmer was a Swiss engineer, who, in his day, was one of the foremost mechanical engineers in Europe. He was born at Zurich, in 1786, and, when young, began his career as a millwright, that term meaning then, a constructor of all kinds of machinery. He made his way into Germany and Russia, where he held honorable commissions, and in 1833 went to Manchester, where he founded a machine works, invented and constructed nearly all kinds of machine tools known to modern practice.

"I will read a short extract from a memoir of Bodmer, in the minutes of the Institution of Civil Engineers, London, dated 1868:

" 'Mr. Bodmer approved so highly of the French metrical system of measures that he adopted it, and made use of it in all his drawings and constructions. He also, from the first, introduced it into his workshops in England; and so far from experiencing any difficulties in this matter, on the part of the men, they understood it immediately, and liked it, at least, as much as the duodecimal system represented by the old foot-rule, and the subdivision of the inch into "eighths," "sixteenths," and "thirty-seconds." A number of wooden staves of half a meter in length, accurately marked and divided, by a machine made expressly for that purpose, into decimeters, centimeters and millimeters, were distributed amongst the workmen; and although they would frequently, by way of abbreviation, call a "millimeter" a "meter," the misnomer did not lead to any errors. For the use of the pattern-makers, the measuring staves were divided so as to include an allowance for the contraction of the metal, that allowance never being left dependent upon the private judgment of the men. Besides, there was in existence, and accessible to the workmen on application to the foreman, a complete system of distinctly marked and accurately executed internal and external gages of various kinds, so that any required measure could be tested, either directly, or by means of the calipers, if required.'

"It is more than probable that Sir Joseph Whitworth's pin and collar gages have this orgin. He was then a young

mechanic of Manchester, and must have known of, if he did not see, Mr. Bodmer's gages, but such facts should not detract from the important service rendered by him to constructive mechanical and engineering processes. In all practical views of the matter he gave to the world accurate implements for machine fitting and, it may be said, accurate methods generally."

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Asbestos.

The use of asbestos in manufacturing is increasing, and new uses are being almost daily found for it—uses for which a satisfactory substitute might be hard to find. The following abstract from an article on this subject, which we find in the "Evening Post," may therefore prove interesting:

"In itself, asbestos is a physical paradox, a mineralogical vegetable, both fibrous and crystalline, elastic yet brittle, a floating stone, but as capable of being carded, spun and woven as flax, cotton or silk. It is apparently a connecting link between the vegetable and the mineral kingdom, possessing some of the characteristics of both. In appearance it is light, buoyant and feathery as thistledown; yet, in its crude state, it is dense and heavy as the solid rock in which it is found. Apparently as perishable as grass, it is yet older than any order of animal or vegetable life on earth. The dissolving influences of time seem to have no effect upon it. The action of unnumbered centuries, by which the hardest rocks known to geologists are worn away, has left no perceptible imprint on the asbestos found imbedded in them. While much of its bulk is of the roughest and most gritty materials known, it is really as smooth to the touch as soap or oil. Seemingly as combustible as tow, the fiercest heat cannot consume it, and no known combination of acids will destructively affect the appearance and strength of its fiber, even after days of exposure to its action. It is, in fact, practically indestructible. Its incombustible nature renders it a complete protection from flames; but beyond this most valuable quality, its industrial value is greatly augmented by its non-conduction of heat and electricity, as well as by its important property of practical insolubility in acids.

"As a matter of fact, Canada contains the great asbestos region of the world, in the sense that while its mines are practically unlimited in productive capacity, the product is of a quality which fully meets the requirements of the newest and most exacting of the innumerable uses that are daily being found for it.

"One of the largest branches of asbestos manufacture is that of sectional cylinders for pipe coverings for retaining the heat of steam and other pipes, felt protective coverings for boilers, frost-proof protections for gas or water pipes, and cement felting, which can be laid on with a trowel, for the covering of steam pipes, boilers or stills. In some of these cases, where it is only necessary to retain the heat, the asbestos is mixed with other substances; but where the protection must be fireproof as well, only asbestos is used. The utility of such covering is well illustrated in the heating system of railway cars. The main pipe from which the individual cars draw their respective supplies is protected by this material.

"To the electrical engineer, asbestos is absolutely indispensable. Many parts of electrical devices and machinery and wires through which the electric current passes become heated, and were it not for the electrical insulation and heat-resisting qualities which asbestos possesses, the apparatus would be completely destroyed, particularly in the case known to electricians as 'short-circuiting.' For such purposes it has been found advisable to combine asbestos with rubber and other gums, and this combination is now used universally for not only electrical, but also steam and mechanical purposes."

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Bicycle Chain Tests.

The Crescent Fire-arms Co., of Norwich, Conn., made the chains for the "sextet" bicycle, of which we hear so much. There were six sets of chains, or forty-two in all, as follows: One 5-16-inch, 54 links; one ⅜-inch, 59 links; one 5-16-inch, 58 links; four ¼-inch, 54 links. The side links, instead of being scalloped, are punched out with straight sides.

A correspondent informs us that the center blocks of these chains were punched out instead of being cut from the bar and drilled, and that such links were found to be stronger. At 1,500 pounds strain, the chain with solid center blocks stretched 1⅛ inches, but with center punched from same stock as side links, it stretched only $\frac{1}{16}$ inch. Both these tests were with soft chains; with the chains hardened, the punched center chain stood 1,900 pounds and stretched $\frac{1}{64}$ inch.

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What is said to be the largest chain ever made has been forged at the Tipton Green Chain Works for the British Admiralty. It is a sling chain, close-linked, of 3 13-16 iron, and side welded. There is no testing machine strong enough to break it, but it is to be tested to about 400 tons. It is to be used for lifting ingots and armor plates.

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The Navy Department is advertising for proposals for furnishing rough-bored and turned forgings for breech-loading guns: 20 sets of 4-inch, 35 sets of 5-inch, 50 sets of 6-inch and 2 sets of 8-inch are wanted.

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The Savage magazine rifle has been unanimously recommended by a commission appointed by Governor Morton, for adoption for the use of the National Guard of the State of New York.

At Hull, Mass., a fly-wheel in an electric power station burst on the 12th inst., wrecking the engine house and damaging other property. The cause of the accident is said to have been "the giving-out of a spring of the governor, and the engine ran wild!"

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The annual meeting of the National Railroad Master Blacksmiths' Association will be held at Chicago, beginning at 10 o'clock, September 1st, 1896, at the Tremont House. The indications are that the attendance will be large. A specially interesting program of pertinent topics has been arranged.

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A correspondent referring to our report of the disastrous and fatal explosion on the German man-of-war "Brandenburg," by which a number of men lost their lives, states that he saw in a German paper recently a statement to the effect that the two engineers making the calculations and superintending the erection of the steam pipes on the vessel have been sentenced to serve one month in jail.

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A writer in "Town Topics," speaking of the effort of the superintendent of the Naval Academy to have Commodore Melville disciplined for criticizing that institution, says: "Now, to the outsider all this sort of thing seems not only *banal* nonsense, but decidedly adverse to the best interests of the naval service, and calculated to raise doubts as to whether the largely military and scientific course pursued at Annapolis is, after all, the best possible mode of providing a corps of naval officers, pure and simple; not accomplished men who fit in well with scientific and social duties and vocations on shore, but men who love the sea and the ship, and who know the latter, from the double bottom to the top of her military mast, with all the appurtenances intervening. In the English service they begin the instruction of the naval neophyte by catching him young and finding out whether his physical and moral idiosyncrasies are such as to fit him for the career of a sea officer; in ours, a capacity to absorb difficult mathematics in large lumps, and a contempt for the men who supervise the machinery which drives the ship, seem to constitute the highest standard of excellence. Perhaps when the currency question is settled, and the national revenue is adjusted, there may be a committee appointed to look into these matters and to find out whether we have, after all, attained the *ne plus ultra* of naval training."

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Someone has said that "cheek" is the next thing to brains, and that a combination of the two is invincible. Such a combination is not found, however, in the man who sends in a sketch of an important part of a machine, and asks us to make

calculations for its proportions to fit given conditions, publish the result, and send him, gratis, a copy of the paper in which it appears.

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Commercial Review.

NEW YORK, SATURDAY EVENING, JULY 18TH.

Machinists' Supplies.

It should not be many weeks hence that some resumption of trade, following the midsummer period, will begin to set in. This will probably be hampered to a notable degree by the disturbances and uncertainties of election time; but if there is an upward movement, however gradual, it will furnish pleasanter reading than the continuous downward one which has characterized the past. The fact that little is doing this month is not, in itself, a thing to occasion much disappointment.

It is unnecessary here to expatiate upon the political aspects of trade, as writers of trade reports, now-a-days, are fond of doing. Enough, and more than enough, is published in the daily newspapers to show what an intimate connection exists this year between politics and business.

The present is a period when purchases are limited principally to immediate requirements, and even these are not large, because many bicycle and other factories have shut down after their season's work. They do so, as a general thing, with the intention of opening again before long; but it is a question whether their action in this respect, as is the case with some of the iron furnaces which have been blowing out, will not be determined largely by prevailing conditions.

The early portion of July is a time when many manufacturers take stock. It is to be expected then, that it should be characterized by a cessation of trade, which may be continued for many weeks. Whether it is designated as "stock taking time," or "repair time" or "between seasons" or "midsummer dulness" it is a well known phase of trade. It is one of the dark hours which under normal circumstances precede morning.

In a general way prices are tending to weakness, although actual reductions are somewhat difficult to locate when one has the whole broad subject of machinists' supplies in view. Wrought iron pipe and boiler tubes have subsided to lower quotations during the last month, and the situation in respect to them is generally unsatisfactory.

One of the most important power-transmitting machinery concerns in this city reports an easing-off of its trade, after a good business which lasted until a few days ago. But most of those who sell power transmitting machinery have been complaining of the dulness for a long time past.

We learn from the Standard Tool Co., of Cleveland, O., manufacturers of chucks, twist drills, reamers, etc., that up to a short time after the first of this month they were securing a great many orders, but that a very sharp falling-off of business has since occurred; attributable, very likely, to a suspension of work by the bicycle and other factories.

The prices of leather belting are reported by some sellers unchanged, by others lower. The weakness is owing to lack of demand rather than to cost of the raw material, for hides are strong and belting butts also are firm in price. Fewer hides than usual were made into butts this year, other applications being chosen for them instead; and this helps to sustain the prices of butts. June and July are usually dull months for the belting trade, and are pronounced especially so this season.

Published reports of the general hardware market, which in part is identical with that of "machinists' supplies" emphasize this prevailing listless state of affairs. Collections are difficult and prices weak in tone. The dulness is not confined to the mechanical lines of trade. Gold exports hamper stocks and, depressed by the news of the illness of Cornelius Vanderbilt, a few days since, the Vanderbilt shares made a rapid decline of many millions of dollars. One of the few favorable features of the general situation is the good crop outlook. It is said also that the railroad companies are ordering more cars and locomotives.

The Nowotny Electric Co., of Cincinnati, O., write in respect to the half-year's business: "We are pleased to report that, with us, there is a marked improvement in all our lines, and more particularly in dynamos and motors, over the first six months of last year."

Iron and Other Metals.

Iron and steel continue to maintain a tone of extreme sluggishness. A meeting of pig iron producers was held in Philadelphia, a few days since, for the purpose of attempting to form a combination, but was adjourned without the result having yet been accomplished. The "gentlemen's agreement" which erstwhile dominated, or tried to dominate, Birmingham irons is not able to maintain itself in the face of present circumstances.

The copper market has been quiet during the past week in both London and New York. The London quotations for Lake ingot closed the week at the opening price, having attained higher figures in the meantime.

The business in pig tin has been conservative, and prices for prompt deliveries have been steady, both here and abroad.

Lead, spelter and antimony have been dull and featureless.

Quotations.

NEW YORK, Monday, July 20th.

Iron—American pig, tidewater delivery:	
No. 1 foundry, Northern	$12 00 @ $13 25
No. 2 foundry, Northern	11 75 @ 12 25
No. 2 plain, Northern	10 75 @ 11 00
Gray Forge	10 75 @ 11 00
No. 1 foundry, Southern	11 25 @ 11 50
No. 2 foundry, Southern	10 75 @ 11 00
No. 3 foundry, Southern	$10 50 @ $10 75
No. 1 soft, Southern	10 50 @ 11 00
No. 2 soft, Southern	10 25 @ 10 75
Foundry forge, Southern	10 00 @ 10 50

Bar Iron—Base, in Carloads—Mill price, on dock: common, 1.10 @ 1.20c.; refined, 1.20 @ 1.50c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.70c.

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—From store, about 1.75. Special brands upward.

Cold Rolled Steel Shafting—Base size in carloads, about 2½c.; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 11¼ @ 11½c.; electrolytic, 11 @ 11¼c.; casting copper, 10¾ @ 11c.

Pig Tin—For 5 and 10-ton lots, 13.55 @ 13.60c. f. o. b.

Pig Lead—In carloads, 2.95 @ 2.97½c.

Spelter—In carload lots New York delivery 4.05 @ 4.10c. for standard Western brands; lower grade at 4.00c.

Antimony—Cookson's, 7.30 @ 7.35; Hallett's, 6.55 @ 6.65c.; Japanese, 6½c.

Lard Oil—Prime city, 40 @ 42c.

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Manufactures.

The Raymond Sewing Machine Factory at Guelph, Ont., is being enlarged.

The Economy Gas Company, Lebanon, Pa., intends to install new gas machinery.

At Pensacola, Fla., a new water works plant is to be erected, which will cost $50,000.

The Gallatin Coal Co., Pittsburgh, Pa., are about to install new machinery for coal mining.

The Cold Stream Water Co., Scranton, Pa., has been granted a charter. Capital, $100,000.

The Norfolk Machinery Co., Norfolk, Va., will erect a plant and also install new machinery.

Watson & Malcolm, Kincardine, Ont., are increasing the capacity of their furniture factory.

A number of residents of St. George, Ont., are agitating an electric light system for that village.

The Elizabethtown Wagon Co., Elizabethtown, Pa., will erect a plant and install new machinery.

Frostburg & Killinger, Chester, Pa., will remodel their brewery and install a line of new machinery.

The construction of an electric street railway in Quebec City, Que., Canada, has been decided upon.

Vandergrift Lumber Co., Vandergrift, Pa., has just organized, and will install a line of new machinery.

F. S. Barker, Scranton, Pa., will erect a bicycle factory, which will be fitted up with new machinery.

The Record Publishing Co., Allegheny, Pa., is about to place new printing presses, ruling machines, etc.

John H. Taggart Pub. Co., Philadelphia, Pa., intend to install a line of printing presses, ruling machines, etc.

The City of Waltham, Mass., intends in the near future to install an additional pump for its water department.

The Board of Works at Fredericton, N. B., have completed plans for a $20,000 bridge at St. Joseph N. B., Canada.

Luther M. Watkins, Hagerstown, Md., is forming a company to manufacture organs, and will instal new machinery.

A number of business men of St. Joseph, Mich., are planning to secure the location of a bicycle factory at that place.

The old Delabole Slate Co., Bangor, Pa., have organized, and will install a line of new and latest improved machinery.

McCool Tube Co., Beaver Falls, Pa., will erect a large plant for the manufacture of tubes and will place new machinery.

A new firm to manufacture fire brick has been organized at Philipsburg, Pa. It is known as the Iron City Fire Brick Co.

The Delaware River Power Co., Morrisville, Pa. will erect a large light and power plant and install a line of new machinery.

The Plymouth Coal Company, Wilkesbarre, Pa., will buy a line of new machinery for mining coal. Capital, $300,000.

A new machine shop and foundry will be erected by John Carr at Grafton, W. Va. Mr. Carr will purchase machinery.

The P. H. Carr Manufacturing Company are erecting a large woolen mill at East Taunton, Mass. P. H. Carr is president.

C. F. Dwyer, Millersburg, Pa., will erect a steam flour mill and will equip the same with all the latest improved machinery.

Gabriel Mover, Mount Joy, Pa., manufacturer of carriages, wagons, etc., will build, and also install new and improved machinery.

J. Findlay & Co., Vancouver, B. C., announce their intention of establishing a plant for the manufacture of mining machinery.

Fyans, Blackway & Fraser, machinists, of Fall River, Mass, will start a branch shop to do mill repairs, at New Bedford, Mass.

The Talbot Brussels Carpet Company is the name of a $200,000 capital company seeking incorporation at Montreal, Que., Canada.

The Kavanaugh Machine Co. are building a large brick machine shop at Zelienople, Pa., for the manufacture of oil well drilling tools.

The Blackham Enameling Works buildings at Zelienople, Pa., are nearly completed and ready for the placing of the new machinery.

The Springborough Canning & Preserving Co., Springborough, Pa., will build a plant which will be equipped with new machinery.

The Cresson Water Co., Cresson, Pa., will build a water works, which will be equipped with new machinery of the latest improved type.

The North Side Traction Co., Pittsburgh, Pa., will build a new plant which will be equipped with new machinery, including cars, etc.

The Pittsburgh Granite Wool Works are just completing a large new works at Zelienople, Pa., for the manufacture of granite wool.

C. W. Taylor, New Cumberland, Penn., will erect a machine shop which will be equipped with a line of new and improved machinery.

E. Flurrie & Bro., Newport, Pa., will erect a brick plant at New Cumberland, Pa., and will place a line of new and improved machinery.

The Board of Works at Springhill, Nova Scotia, is urging the expenditure of $100,000 for the construction of a system of water works.

George Stauffer, No. 304 Reily street, Harrisburg, Pa., will erect a large dye house and will place the latest improved machinery throughout.

The Riverside Iron Company of Wheeling, W. Va., are making extensive improvements to their works during the hot weather shut down.

A party of Montrealers has been gazetted as the Jean Rensz Cigarmaking Machine Company of Montreal, Que., with a capital of $225,000.

The E. H. Fitler Co., Philadelphia, Pa., will erect an immense plant to manufacture cordage and will install new machinery. Capital, $1,500,000.

Huron Hardwood Handle Company, Alpena, Mich., will install new woodworking machinery of every description, pumps and engines.

The Detroit & Macinac Railway Company's new repair and car shops will be located at West Bay City, Mich. All new machinery will be put in.

The Albion Milling Co., Albion, Mich., will thoroughly re-equip their large flouring mills with the latest improved machinery, in the near future.

George B. Grant has moved his gear works from Lexington, Mass., to No. 6 Portland street, Boston, and the Lexington shops will be leased or sold.

The Glasgow Iron Co. will make large additions to their plant in Pottstown, Pa., during the hot season, including a large open hearth steel plant.

The Lackawanna Wheel Co., Scranton, Pa., will erect works to manufacture bicycles, tricycles and other vehicles. They will install new machinery.

The American Stock Fence Co., Baltimore, Md., has been incorporated, and will place new machinery for manufacturing iron fence. Capital $100,000.

The Covel Machine Company's shops at Fall River, Mass., were destroyed by fire recently, and will be rebuilt and equipped with new machinery.

The Enterprise Mfg. Co., Philadelphia, Pa., will erect a large building for the manufacture of hardware, and will install a line of first-class machinery.

Ground has been broken at Dobbin, W. Va., for the large handle factory of Leech & Co. The plant will employ over 200 men when run to its fullest capacity.

The Somerset (Mass.) Iron Works, recently destroyed by fire, will rebuild, and will be equipped with the most modern machinery. Capital stock, $100,000.

Bradford Enameling Co., Bradford, Pa., have organized for manufacturing enamel ware and will place a line of new machinery. Capital stock, $100,000.

The new firm known as the Fox Pressed Steel Co. has the plans for its new works about completed and will begin the building of them as soon as possible.

The Alpena Spruce Fibre Co., Alpena, Mich., will make important improvements in their plant at once; fibre paper manufacturing machinery will be installed.

George D. Wetherill & Co., Philadelphia, Pa., will organize for the manufacture of paints, varnishes, oils, etc., and will buy an entire new machinery outfit.

The Chantrell Tool Co., Reading, Pa., will increase their plant to double its capacity and will place new machinery. They manufacture tools, bicycle chains, etc.

A company has been formed at Ingersoll, Ont., to take over the old Russel foundry. They will prepare lumber for bicycle rims for Canadian and American factories.

The Attleboro & Brockton, Mass. Street R. R. Co., will spend $100,000 to enlarge their power house. It is their intention to put in new engines and other machinery.

A company has been formed at New Brighton, Pa., for the manufacture of a new power transmitter invented by W. L. Crouch. It is applicable to street cars, bicycles, etc.

Negotiations are in progress between the Homestead Manufacturing Company and capitalists of Media, O., for the removal of their works to Media. The company employ 50 men.

The Waltham Manufacturing Company (manufacturers of the Orient Bicycle) Waltham, Mass., are to enlarge their factory and intend to install new machinery for the same.

Graphite Works are being erected at Ottawa, Canada. The ore comes from the Renfrew district. A new plant will be put in operation and the ore treated by a new process.

C. Muench & Son's Co., Alpena, Mich., will erect a complete tannery, which will employ 300 extra hands. Engines, pumps, grinders and other labor-saving machinery will be installed.

The Alpena Woolen Mills, Alpena, Mich., will double the present capacity of their large woolen plant. All new labor-saving machinery will be put in, as soon as buildings are completed.

The Elizabethtown Electric Light, Heat and Power Co., Elizabethtown, Pa., will build an electric plant and will install boilers, engines, dynamos, belting, shafting, pulleys, etc.

The Shepard-Scaife Cigar Machinery Co., Pittsburgh, Pa., will build a plant at once for the manufacture of cigar machinery, and will equip the plant with new machinery. Capital, $5,000.

A new company has been organized at Warren, Ohio, known as the Spellman Manufacturing Co., to be located at Cortland, Ohio. It will make saws and other devices, patents of I. H. Spellman.

The reorganized Otis Steel Company of Cleveland, O., are thoroughly modernizing and overhauling the old plant. The improvements are under the direction of a London engineer, Jeremiah Head.

Lea & Carroll, of Pittsburgh, Pa., will fit out a complete machine shop for building a fine class of special machinery, which will be operated in connection with their business as contracting engineers.

The Bloomsburg Elevator and Machine Works, Bloomsburg, Pa., will at once erect a plant to manufacture elevators, general foundry and machine work. Capital $50.000. They will place new machinery..

The Toronto Radiator Co., Toronto, Canada, have taken out a permit for an addition to their extensive premises on Dufferin street, at a cost of $10,000. The addition is to be devoted to foundry purposes.

The Riverside Manufacturing Co., Connellsville, Pa., have incorporated for the manufacture of waste materials such as lead, copper, brass and all all kinds of iron waste, and will install new machinery.

J. G. Mitcheltree, of Middlesex, and Hon. E. A. Wheeler, of Sharon, Pa., have applied at Harrisburg for a charter for the erection of a large mill for the manufacture of corrugated steel roofing at Middlesex, Pa.

The Halifax Breweries (Limited) Dartmouth, Nova Scotia, have decided to rebuild the works recently destroyed by fire. The new one will be larger and on the most approved plans, and the machinery of the latest pattern.

Goderich, Ont., will submit to the electorate at an early date money by-laws for the following sums: $12,000 for a stand pipe and lake extension for waterworks; $6,000 for an incandescent electric light system, and $20,000 for permanent sewers.

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Thomas Robinson, of West Hartlepool, England, will establish at London, Ont., Canada, a branch export house with mammoth refrigerator and cold storage appurtenances. Mr. Benj. Higgins will be the manager, and the new industry will employ a large number of hands.

The Carnegie Steel Company has concluded the deal with the Oliver heirs, for the purchase of 40 acres of land at Duquesne, Pa., to cost $200,000. The ground, it is understood, will be used as a site for the new forging plant the company proposes to erect at a cost of $1,000,000.

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The Seymour Manufacturing Company, of Seymour, Conn., are enlarging their boiler house, and the new portion of the building will be constructed entirely of steel in order to make it absolutely fireproof. The contract for the steel work has been

let to the Berlin Iron Bridge Company, of East Berlin, Conn.

H. W. Hartman, the president of the Pittsburgh company which is booming Elwood City, Pa., will return from Europe next week. When abroad he visited Sweden and examined the billets mills there. He intends to build a similar one at Elwood City. The billets will be used for the manufacture of bicycle tubing.

At Camden, N. J., a new company known as the Carriage Cycle Co., has been incorporated. This company is to engage in the manufacture and sale of carriage cycles. The capital stock is $250,000, and the incorporators are James Buckman, Lawrence Litchfield, and Lorenzo Schwerin, all of whom belong to Philadelphia, Pa.

The Dominion Cold Storage Company, of Montreal, Que., Canada, through their secretary, T. H. Rothwell, propose to build a warehouse of 500,000 cubic feet capacity, and equipped with an ammonia refrigerating plant and other modern appliances, to cost from $100,000 to $125,000, at London, Ont., provided certain privileges are granted by the city council.

Articles of incorporation have been issued to the Cleveland (O.) Brazed Fork and Tubing Company, with a capital stock of $12,500. The company is incorporated to manufacture, sell, and deal in brazed fork sides, bicycle sundries, and hardware specialties. The incorporators are E. Rosenfeld,

(*Continued on page 23.*)

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Help Wanted.

Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our subscription list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Pos. as brass foundry foreman; good ref. as to ability and char. Box 200, Am. Mach.

Exp. mechanical draftsman wants position; good refs. Max Brauner, No. 65 St. Marks Place, N. Y.

Dftsman., experienced on steam eng., gen'l and spec'l machy., wants position. Box 215, Am. Mach.

Comp. draftsman, grad. wants pos.; exp. in design'g engs., boilers, gen. machy. E. P., Am. Mach.

Wanted Pos. as drfst. on dynamos, motors, bicycles, spec. mach., tools. Refs. Box 206, Am. Mach.

Situation wanted by man who knows how to design and build gas engines. Address, Box 209, American Machinist.

Practical mach. designer, of 6 years' mach. shop and 8 years' drawing room experience on general and special machinery. Add. Box, 221, Am. Mach.

First-class tool maker desires position; accustomed to designing, experim't'g, etc., and successful in handling help. Address Box 219, Am. Mach.

Wanted—Position in line of mechanical engineering by graduate in technical college; have had shop practice in general machine work. Address H. H., 1518 Spring Garden Street, Philadelphia, Pa.

An energetic foreman open to engagement. Tech. graduate with 14 years' pract. exp. In executive ability, and estimating on cost of machinery, A1. Good references. Box 211, American Machinist.

Wanted—By manufacturers of engines and dynamos, in Pennsylvania, a foreman; only a first-class man need apply. Write, giving references and experience. Box 202, American Machinist.

Good all-round machinist, young, ambitious and fully experienced in overhauling printing presses, desires position; would like to start where there is prospect of advancement. Box 216, Am. Mach.

Wanted—Position by experienced mech'l dftsmn., technical graduate; experienced in steam, power transmission and general machinery; good mech'l ideas; ref. if desired. Box 223, Amer. Machinist.

Wanted—Situation by toolmaker to take charge of screw mach. work; 15 years' experience with large electric concern; can handle men and tools with best results. Address Box 213, Am. Mach.

Mech. eng. wants position; 21 years' experience in marine, Corliss and gen. eng. and boilermaking; 10½ years shop and drawing office; 8½ years supt. and asst. mgr.; 2 years sea-going experience. Box 217, American Machinist.

Mech. eng. with tech. education received at best institute in Mass. desires a change; thoroughly practical in design of engs., pumps ice mach., etc.; well acq. with compet. meth. of well-equipped and successful shops. Box 222, American Machinist.

Iron moulder, age 40; late foreman; married; sober and steady; good workman, either green or dry sand; have been out of employment four months; would like employment as workman; will any brother foreman give it me, either in Jersey or New York States. Box 220, American Machinist.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York.Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co.

For sale—Buckeye Eng., pract. new, 11x14, rating 70 to 90 H.P., $450.00. S. M. York, Cleveland, O.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars Prices low and samples free. Middletown Machine Co. Middletown, Ohio.

Inventors—Patents procured, construction, drawings and inventions perfected by Wm. G. Nelson & Co., mech. engrs. & pat. attys, 108 Fulton st., N.Y.

Cheap for quick sale.—1 Wheeler Planer 42x42, very heavy, first-class condition; cost $1,900, will sell for $650. Butterworth & Lowe, Grand Rapids, Mich.

We offer an exceedingly fine lot of first-class second-hand machinery, lathes, planers, shapers, drills, millers, screw machines, etc. Call or get list 17 B. The Garvin Mach. Co., 440 Canal st., N. Y.

Valuable ...Books.

SHOP KINKS.
By ROBERT GRIMSHAW.
400 pp., 222 illustrations.
Price, $2.50.

THE MODERN MACHINIST.
By JOHN T. USHER.
2d edition. 322 pp., 257 illustrations. Price, $2.50.

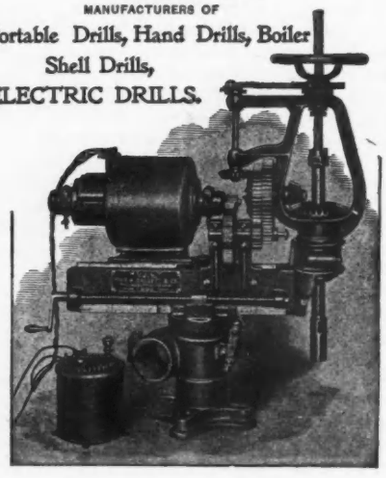
These books show by plain description, and by profuse engravings made expressly for them, all that is best, most advanced, and of the highest efficiency in modern machine shop practice. They are right up to date, and are written by men who understand the subject.

*** Copies mailed on receipt of price, or special circular sent on request.

Send for our catalogue of books for Machinists, Engineers, Electricians, and all practical subjects.

NORMAN W. HENLEY & CO., Publishers,
15 Beekman Street, New York.

THOS. H. DALLETT & CO.
PHILADELPHIA.
MANUFACTURERS OF
Portable Drills, Hand Drills, Boiler Shell Drills,
ELECTRIC DRILLS.

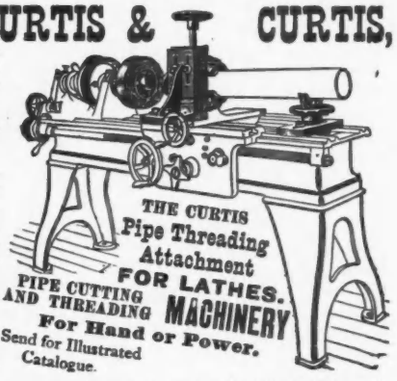


Columbia University
in the City of New York.

SCHOOL OF MINES,
SCHOOL OF CHEMISTRY,
SCHOOL OF ENGINEERING,
SCHOOL OF ARCHITECTURE,
SCHOOL OF PURE SCIENCE.

Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded on application to the Secretary of the University.

CURTIS & CURTIS,
66 Garden St., Bridgeport, Ct.



Send for Illustrated Catalogue.

Some Bargains in Electrical Machinery, Dynamos and Motors, in the following sizes, wound for any voltage, of a Well-Known Make, Fully Warranted, may be had at Very Low Prices.

These Machines are as good as New.

DYNAMOS. Compound Wound.	MOTORS. Shunt Wound.
40 Kw.	50 H.P.
50 "	65 "
60 "	75 "
80 "	100 "
100 "	125 "

Central Stations contemplating the installation of power generators will find it to their advantage to look this up; whereas for isolated lighting a good selection may be had, while in either case money can be saved. Address,

"Electric," care American Machinist.

AUTOMATIC BAND SAW FILER.

REAL PROGRESS. Greatest Labor-Saving Machine in this line. . .
IT PAYS because it increases and improves production and saves saws. A boy can run it. Full particulars in our ad., Vol. 19, No. 27.

P. PRYIBIL,
512-524 West 41st Street, New York.
Cable "Pryibil, Newyork." Use A. B. C. Code.

calculations for its proportions to fit given conditions, publish the result, and send him, gratis, a copy of the paper in which it appears.

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Commercial Review.

NEW YORK, SATURDAY EVENING, JULY 18TH.

Machinists' Supplies.

It should not be many weeks hence that some resumption of trade, following the midsummer period, will begin to set in. This will probably be hampered to a notable degree by the disturbances and uncertainties of election time; but if there is an upward movement, however gradual, it will furnish pleasanter reading than the continuous downward one which has characterized the past. The fact that little is doing this month is not, in itself, a thing to occasion much disappointment.

It is unnecessary here to expatiate upon the political aspects of trade, as writers of trade reports, now-a-days, are fond of doing. Enough, and more than enough, is published in the daily newspapers to show what an intimate connection exists this year between politics and business.

The present is a period when purchases are limited principally to immediate requirements, and even these are not large, because many bicycle and other factories have shut down after their season's work. They do so, as a general thing, with the intention of opening again before long; but it is a question whether their action in this respect, as is the case with some of the iron furnaces which have been blowing out, will not be determined largely by prevailing conditions.

The early portion of July is a time when many manufacturers take stock. It is to be expected then, that it should be characterized by a cessation of trade, which may be continued for many weeks. Whether it is designated as "stock taking time," or "repair time" or "between seasons" or "midsummer dulness" it is a well known phase of trade. It is one of the dark hours which under normal circumstances precede morning.

In a general way prices are tending to weakness, although actual reductions are somewhat difficult to locate when one has the whole broad subject of machinists' supplies in view. Wrought iron pipe and boiler tubes have subsided to lower quotations during the last month, and the situation in respect to them is generally unsatisfactory.

One of the most important power-transmitting machinery concerns in this city reports an easing-off of its trade, after a good business which lasted until a few days ago. But most of those who sell power transmitting machinery have been complaining of the dulness for a long time past.

We learn from the Standard Tool Co., of Cleveland, O., manufacturers of chucks, twist drills, reamers, etc., that up to a short time after the first of this month they were securing a great many orders, but that a very sharp falling-off of business has since occurred; attributable, very likely, to a suspension of work by the bicycle and other factories.

The prices of leather belting are reported by some sellers unchanged, by others lower. The weakness is owing to lack of demand rather than to cost of the raw material, for hides are strong and belting butts also are firm in price. Fewer hides than usual were made into butts this year, other applications being chosen for them instead; and this helps to sustain the prices of butts. June and July are usually dull months for the belting trade, and are pronounced especially so this season.

Published reports of the general hardware market, which in part is identical with that of "machinists' supplies" emphasize this prevailing listless state of affairs. Collections are difficult and prices weak in tone. The dulness is not confined to the mechanical lines of trade. Gold exports hamper stocks and, depressed by the news of the illness of Cornelius Vanderbilt, a few days since, the Vanderbilt shares made a rapid decline of many millions of dollars. One of the few favorable features of the general situation is the good crop outlook. It is said also that the railroad companies are ordering more cars and locomotives.

The Nowotny Electric Co., of Cincinnati, O., write in respect to the half-year's business: "We are pleased to report that, with us, there is a marked improvement in all our lines, and more particularly in dynamos and motors, over the first six months of last year."

Iron and Other Metals.

Iron and steel continue to maintain a tone of extreme sluggishness. A meeting of pig iron producers was held in Philadelphia, a few days since, for the purpose of attempting to form a combination, but was adjourned without the result having yet been accomplished. The "gentlemen's agreement" which erstwhile dominated, or tried to dominate, Birmingham irons is not able to maintain itself in the face of present circumstances.

The copper market has been quiet during the past week in both London and New York. The London quotations for Lake ingot closed the week at the opening price, having attained higher figures in the meantime.

The business in pig tin has been conservative, and prices for prompt deliveries have been steady, both here and abroad.

Lead, spelter and antimony have been dull and featureless.

Quotations.

NEW YORK, Monday, July 20th.

Iron—American pig, tidewater delivery:	
No. 1 foundry, Northern	$12 00 @ $13 25
No. 2 foundry, Northern	11 75 @ 12 25
No. 2 plain, Northern	10 75 @ 11 00
Gray Forge	10 75 @ 11 00
No. 1 foundry, Southern	11 25 @ 11 50
No. 2 foundry, Southern	10 75 @ 11 00
No. 3 foundry, Southern	$10 50 @ $10 75
No. 1 soft, Southern	10 50 @ 11 00
No. 2 soft, Southern	10 25 @ 10 75
Foundry forge, Southern	10 00 @ 10 50

Bar Iron—Base, in Carloads—Mill price, on dock: common, 1.10 @ 1.20c.; refined, 1.20 @ 1.50c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.70c.

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—From store, about 1.75. Special brands upward.

Cold Rolled Steel Shafting—Base size in carloads, about 2½c.; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 11¼ @ 11½c.; electrolytic, 11 @ 11¼c.; casting copper, 10¾ @ 11c.

Pig Tin—For 5 and 10-ton lots, 13.55 @ 13.60c. f. o. b.

Pig Lead—In carloads, 2.95 @ 2.97½c.

Spelter—In carload lots New York delivery 4.05 @ 4.10c. for standard Western brands; lower grade at 4.00c.

Antimony—Cookson's, 7.30 @ 7.35; Hallett's, 6.55 @ 6.65c.; Japanese, 6½c.

Lard Oil—Prime city, 40 @ 42c.

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Manufactures.

The Raymond Sewing Machine Factory at Guelph, Ont., is being enlarged.

The Economy Gas Company, Lebanon, Pa., intends to install new gas machinery.

At Pensacola, Fla., a new water works plant is to be erected, which will cost $50,000.

The Gallatin Coal Co., Pittsburgh, Pa., are about to install new machinery for coal mining.

The Cold Stream Water Co., Scranton, Pa., has been granted a charter. Capital, $100,000.

The Norfolk Machinery Co., Norfolk, Va., will erect a plant and also install new machinery.

Watson & Malcolm, Kincardine, Ont., are increasing the capacity of their furniture factory.

A number of residents of St. George, Ont., are agitating an electric light system for that village.

The Elizabethtown Wagon Co., Elizabethtown, Pa., will erect a plant and install new machinery.

Frostburg & Killinger, Chester, Pa., will remodel their brewery and install a line of new machinery.

The construction of an electric street railway in Quebec City, Que., Canada, has been decided upon.

Vandergrift Lumber Co., Vandergrift, Pa., has just organized, and will install a line of new machinery.

F. S. Barker, Scranton, Pa., will erect a bicycle factory, which will be fitted up with new machinery

The Record Publishing Co., Allegheny, Pa., is about to place new printing presses, ruling machines, etc.

John H. Taggart Pub. Co., Philadelphia, Pa., intend to install a line of printing presses, ruling machines, etc.

The City of Waltham, Mass., intends in the near future to install an additional pump for its water department.

The Board of Works at Fredericton, N. B., have completed plans for a $20,000 bridge at St. Joseph N. B., Canada.

Luther M. Watkins, Hagerstown, Md., is forming a company to manufacture organs, and will instal new machinery.

A number of business men of St. Joseph, Mich., are planning to secure the location of a bicycle factory at that place.

The old Delabole Slate Co., Bangor, Pa., have organized, and will install a line of new and latest improved machinery.

McCool Tube Co., Beaver Falls, Pa., will erect a large plant for the manufacture of tubes and will place new machinery.

A new firm to manufacture fire brick has been organized at Philipsburg, Pa. It is known as the Iron City Fire Brick Co.

The Delaware River Power Co., Morrisville, Pa. will erect a large light and power plant and install a line of new machinery.

The Plymouth Coal Company, Wilkesbarre, Pa., will buy a line of new machinery for mining coal. Capital, $300,000.

A new machine shop and foundry will be erected by John Carr at Grafton, W. Va. Mr. Carr will purchase machinery.

The P. H. Carr Manufacturing Company are erecting a large woolen mill at East Taunton, Mass. P. H. Carr is president.

C. F. Dwyer, Millersburg, Pa., will erect a steam flour mill and will equip the same with all the latest improved machinery.

Gabriel Moyer, Mount Joy, Pa., manufacturer of carriages, wagons, etc., will build, and also install new and improved machinery.

J. Findlay & Co., Vancouver, B. C., announce their intention of establishing a plant for the manufacture of mining machinery.

Fyans, Blackway & Fraser, machinists, of Fall River, Mass, will start a branch shop to do mill repairs, at New Bedford, Mass.

The Talbot Brussels Carpet Company is the name of a $200,000 capital company seeking incorporation at Montreal, Que., Canada.

The Kavanaugh Machine Co. are building a large brick machine shop at Zelienople, Pa., for the manufacture of oil well drilling tools.

The Blackham Enameling Works buildings at Zelienople, Pa., are nearly completed and ready for the placing of the new machinery.

The Springborough Canning & Preserving Co., Springborough, Pa., will build a plant which will be equipped with new machinery.

The Cresson Water Co., Cresson, Pa., will build a water works, which will be equipped with new machinery of the latest improved type.

The North Side Traction Co., Pittsburgh, Pa., will build a new plant which will be equipped with new machinery, including cars, etc.

The Pittsburgh Granite Wool Works are just completing a large new works at Zelienople, Pa., for the manufacture of granite wool.

C. W. Taylor, New Cumberland, Penn., will erect a machine shop which will be equipped with a line of new and improved machinery.

E. Flurrie & Bro., Newport, Pa., will erect a brick plant at New Cumberland, Pa., and will place a line of new and improved machinery.

The Board of Works at Springhill, Nova Scotia, is urging the expenditure of $100,000 for the construction of a system of water works.

George Stauffer, No. 304 Reily street, Harrisburg, Pa., will erect a large dye house and will place the latest improved machinery throughout.

The Riverside Iron Company of Wheeling, W. Va., are making extensive improvements to their works during the hot weather shut down.

A party of Montrealers has been gazetted as the Jean Rensz Cigarmaking Machine Company of Montreal, Que., with a capital of $225,000.

The E. H. Fitler Co., Philadelphia, Pa., will erect an immense plant to manufacture cordage and will install new machinery. Capital, $1,500,000.

Huron Hardwood Handle Company, Alpena, Mich., will install new woodworking machinery of every description, pumps and engines.

The Detroit & Macinac Railway Company's new repair and car shops will be located at West Bay City, Mich. All new machinery will be put in.

The Albion Milling Co., Albion, Mich., will thoroughly re-equip their large flouring mills with the latest improved machinery, in the near future.

George B. Grant has moved his gear works from Lexington, Mass., to No. 6 Portland street, Boston, and the Lexington shops will be leased or sold.

The Glasgow Iron Co. will make large additions to their plant in Pottstown, Pa., during the hot season, including a large open hearth steel plant.

The Lackawanna Wheel Co., Scranton, Pa., will erect works to manufacture bicycles, tricycles and other vehicles. They will install new machinery.

The American Stock Fence Co., Baltimore, Md., has been incorporated, and will place new machinery for manufacturing iron fence. Capital $100,000.

The Covel Machine Company's shops at Fall River, Mass., were destroyed by fire recently, and will be rebuilt and equipped with new machinery.

The Enterprise Mfg. Co., Philadelphia, Pa., will erect a large building for the manufacture of hardware, and will install a line of first-class machinery.

Ground has been broken at Dobbin, W. Va., for the large handle factory of Leech & Co. The plant will employ over 200 men when run to its fullest capacity.

The Somerset (Mass.) Iron Works, recently destroyed by fire, will rebuild, and will be equipped with the most modern machinery. Capital stock, $100,000.

Bradford Enameling Co., Bradford, Pa., have organized for manufacturing enamel ware and will place a line of new machinery. Capital stock, $100,000.

The new firm known as the Fox Pressed Steel Co. has the plans for its new works about completed and will begin the building of them as soon as possible.

The Alpena Spruce Fibre Co., Alpena, Mich., will make important improvements in their plant at once; fibre paper manufacturing machinery will be installed.

George D. Wetherill & Co., Philadelphia, Pa., will organize for the manufacture of paints, varnishes, oils, etc., and will buy an entire new machinery outfit.

The Chantrell Tool Co., Reading, Pa., will increase their plant to double its capacity and will place new machinery. They manufacture tools, bicycle chains, etc.

A company has been formed at Ingersoll, Ont., to take over the old Russel foundry. They will prepare lumber for bicycle rims for Canadian and American factories.

The Attleboro & Brockton, Mass. Street R. R. Co., will spend $100,000 to enlarge their power house. It is their intention to put in new engines and other machinery.

A company has been formed at New Brighton, Pa., for the manufacture of a new power transmitter invented by W. L. Crouch. It is applicable to street cars, bicycles, etc.

Negotiations are in progress between the Homestead Manufacturing Company and capitalists of Media, O., for the removal of their works to Media. The company employ 50 men.

The Waltham Manufacturing Company (manufacturers of the Orient Bicycle) Waltham, Mass., are to enlarge their factory and intend to install new machinery for the same.

Graphite Works are being erected at Ottawa, Canada. The ore comes from the Renfrew district. A new plant will be put in operation and the ore treated by a new process.

C. Muench & Son's Co., Alpena, Mich., will erect a complete tannery, which will employ 300 extra hands. Engines, pumps, grinders and other labor-saving machinery will be installed.

The Alpena Woolen Mills, Alpena, Mich., will double the present capacity of their large woolen plant. All new labor-saving machinery will be put in, as soon as buildings are completed.

The Elizabethtown Electric Light, Heat and Power Co., Elizabethtown, Pa., will build an electric plant and will install boilers, engines, dynamos, belting, shafting, pulleys, etc.

The Shepard-Scaife Cigar Machinery Co., Pittsburgh, Pa., will build a plant at once for the manufacture of cigar machinery, and will equip the plant with new machinery. Capital, $5,000.

A new company has been organized at Warren, Ohio, known as the Spellman Manufacturing Co., to be located at Cortland, Ohio. It will make saws and other devices, patents of I. H. Spellman.

The reorganized Otis Steel Company of Cleveland, O., are thoroughly modernizing and overhauling the old plant. The improvements are under the direction of a London engineer, Jeremiah Head.

Lea & Carroll, of Pittsburgh, Pa., will fit out a complete machine shop for building a fine class of special machinery, which will be operated in connection with their business as contracting engineers.

The Bloomsburg Elevator and Machine Works, Bloomsburg, Pa., will at once erect a plant to manufacture elevators, general foundry and machine work. Capital $50,000. They will place new machinery.

The Toronto Radiator Co., Toronto, Canada, have taken out a permit for an addition to their extensive premises on Dufferin street, at a cost of $10,000. The addition is to be devoted to foundry purposes.

The Riverside Manufacturing Co., Connellsville, Pa., have incorporated for the manufacture of waste materials such as lead, copper, brass and all all kinds of iron waste, and will install new machinery.

J. G. Mitcheltree, of Middlesex, and Hon. E. A. Wheeler, of Sharon, Pa., have applied at Harrisburg for a charter for the erection of a large mill for the manufacture of corrugated steel roofing at Middlesex, Pa.

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The Seymour Manufacturing Company, of Seymour, Conn., are enlarging their boiler house, and the new portion of the building will be constructed entirely of steel in order to make it absolutely fireproof. The contract for the steel work has been

let to the Berlin Iron Bridge Company, of East Berlin, Conn.

H. W. Hartman, the president of the Pittsburgh company which is booming Elwood City, Pa., will return from Europe next week. When abroad he visited Sweden and examined the billets mills there. He intends to build a similar one at Elwood City. The billets will be used for the manufacture of bicycle tubing.

At Camden, N. J., a new company known as the Carriage Cycle Co., has been incorporated. This company is to engage in the manufacture and sale of carriage cycles. The capital stock is $250,000, and the incorporators are James Buckman, Lawrence Litchfield, and Lorenzo Schwerin, all of whom belong to Philadelphia, Pa.

The Dominion Cold Storage Company, of Montreal, Que., Canada, through their secretary, T. H. Rothwell, propose to build a warehouse of 500,000 cubic feet capacity, and equipped with an ammonia refrigerating plant and other modern appliances, to cost from $100,000 to $125,000, at London, Ont., provided certain privileges are granted by the city council.

Articles of incorporation have been issued to the Cleveland (O.) Brazed Fork and Tubing Company, with a capital stock of $12,500. The company is incorporated to manufacture, sell, and deal in brazed fork sides, bicycle sundries, and hardware specialties. The incorporators are E. Rosenfeld,

(Continued on page 23.)

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Help Wanted.

Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Pos. as brass foundry foreman; good ref. as to ability and char. Box 200, AM. MACH.

Exp. mechanical draftsman wants position; good refs. Max Brauner, No. 65 St. Marks Place, N. Y.

Dftsman., experienced on steam eng., gen'l and spec'l machy., wants position. Box 215, AM. MACH.

Comp. draftsman, grad. wants pos.; exp. in design'g engs., boilers, gen. machy. E. P., AM. MACH.

Wanted Pos. as drfst. on dynamos, motors, bicycles, spec. mach., tools. Refs. Box 206, AM. MACH.

Situation wanted by man who knows how to design and build gas engines. Address, Box 209, AMERICAN MACHINIST.

Practical mach. designer, of 6 years' mach. shop and 8 years' drawing room experience on general and special machinery. Add. Box, 221, AM. MACH.

First-class tool maker desires position; accustomed to designing, experim't'g, etc., and successful in handling help. Address Box 219, AM. MACH.

Wanted—Position in line of mechanical engineering by graduate in technical college; have had shop practice in general machine work. Address H. H., 1518 Spring Garden Street, Philadelphia, Pa.

An energetic foreman open to engagement. Tech. graduate with 14 years' pract. exp. In executive ability, and estimating on cost of machinery, A1. Good references. Box 211, AMERICAN MACHINIST.

Wanted—By manufacturers of engines and dynamos, in Pennsylvania, a foreman; only a first-class man need apply. Write, giving references and experience. Box 202, AMERICAN MACHINIST.

Good all-round machinist, young, ambitious and fully experienced in overhauling printing presses, desires position; would like to start where there is prospect of advancement. Box 216, AM. MACH.

Wanted—Position by experienced mech'l dftsmn., technical graduate; experienced in steam, power transmission and general machinery; good mech'l ideas; ref. if desired. Box 223, AMER. MACHINIST.

Wanted—Situation by toolmaker to take charge of screw mach. work; 15 years' experience with large electric concern; can handle men and tools with best results. Address Box 218, AM. MACH.

Mech. eng. wants position; 21 years' experience in marine, Corliss and gen. eng. and boilermaking; 10½ years shop and drawing office; 8½ years supt. and asst. mgr.; 2 years sea-going experience. Box 217, AMERICAN MACHINIST.

Mech. eng. with tech. education received at best institute in Mass. desires a change; thoroughly practical in design of engs., pumps ice mach., etc.; well acq. with compet. meth. of well-equipped and successful shops. Box 222, AMERICAN MACHINIST.

Iron moulder, age 40; late foreman; married; sober and steady; good workman, either green or dry sand; have been out of employment four months; would like employment as workman; will any brother foreman give it me, either in Jersey or New York States. Box 220, AMERICAN MACHINIST.

▲ ▲ ▲

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York.Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co.

For sale—Buckeye Eng., pract. new, 11x14, rating 70 to 90 H.P., $450.00. S. M. York, Cleveland, O.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co. Middletown, Ohio.

Inventors—Patents procured, construction, drawings and inventions perfected by Wm. G. Nelson & Co., mech. engrs. & pat. attys., 108 Fulton st., N.Y.

Cheap for quick sale.—1 Wheeler Planer 42 x 42, very heavy, first-class condition; cost $1,900, will sell for $650. Butterworth & Lowe, Grand Rapids, Mich.

We offer an exceedingly fine lot of first-class second-hand machinery, lathes, planers, shapers, drills, millers, screw machines, etc. Call or get list 17 B. The Garvin Mach. Co., 440 Canal st., N. Y.

Valuable ...Books.

SHOP KINKS.
By ROBERT GRIMSHAW.
400 pp., 222 illustrations.
Price, $2.50.

THE MODERN MACHINIST.
By JOHN T. USHER.
2d edition. 322 pp., 257 illustrations. Price, $2.50.

These books show by plain description, and by profuse engravings made expressly for them, all that is best, most advanced, and of the highest efficiency in modern machine shop practice. They are right up to date, and are written by men who understand the subject.

*** Copies mailed on receipt of price, or special circular sent on request.

Send for our catalogue of books for Machinists, Engineers, Electricians, and all practical subjects.

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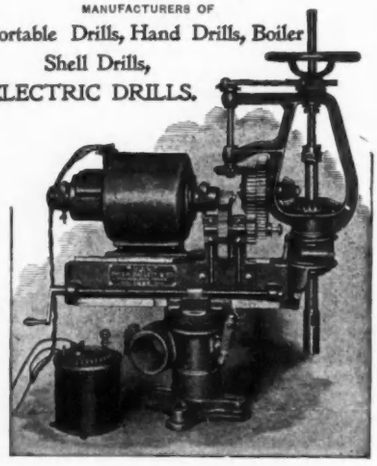
PHILADELPHIA.
MANUFACTURERS OF
Portable Drills, Hand Drills, Boiler Shell Drills, ELECTRIC DRILLS.



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Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded on application to the Secretary of the University.

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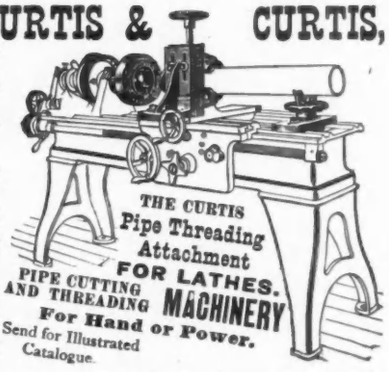
66 Garden St., Bridgeport, Ct.



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Some Bargains in Electrical Machinery, Dynamos and Motors, in the following sizes, wound for any voltage, of a Well-Known Make, Fully Warranted, may be had at Very Low Prices.

These Machines are as good as New.

DYNAMOS. Compound Wound.	MOTORS. Shunt Wound.
40 Kw.	50 H.P.
50 "	65 "
60 "	75 "
80 "	100 "
100 "	125 "

Central Stations contemplating the installation of power generators will find it to their advantage to look this up; whereas for isolated lighting a good selection may be had, while in either case money can be saved. Address,

"Electric," care AMERICAN MACHINIST.

AUTOMATIC BAND SAW FILER.

REAL PROGRESS. Greatest Labor-Saving Machine in this line . .
IT PAYS because it increases and improves pro-
IT PAYS duction and saves saws. A boy can run it. Full particulars in our ad., Vol. 19, No. 27.

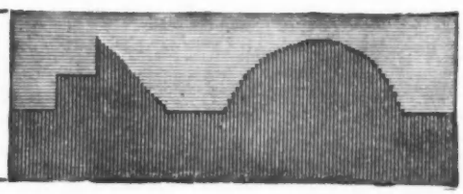
P. PRYIBIL,
512-524 West 41st Street, NEW YORK.
Cable "Pryibil, Newyork," Use A. B. C. Code.

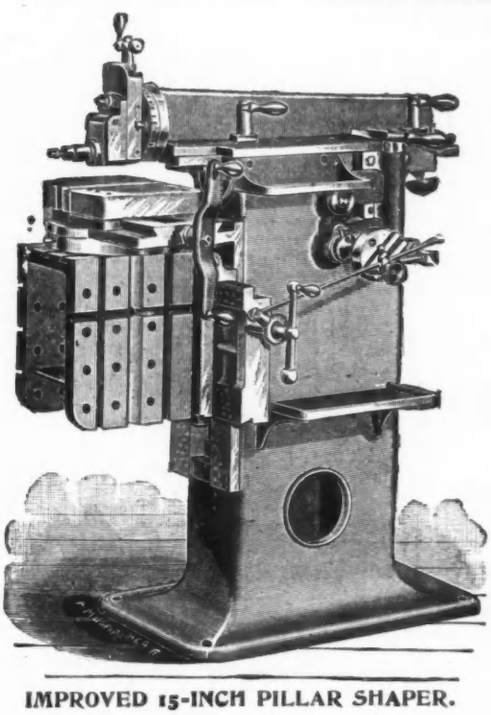
IMPROVED
15-inch Hendey Shaper

LATEST IMPROVEMENTS.
USEFUL ATTACHMENTS.
STRONG AND POWERFUL.

For Die Work, Tool Room, or General Machine Shop Work.

This Cut shows how stroke can be Adjusted with Machine in motion by the Micrometer Adjustment, fine and delicate.





The Stroke can be adjusted for Curves with machine in motion.

The Stroke can be adjusted for Angles with machine in motion.

The Stroke can be adjusted for Irregular work with machine in motion.

It has Adjustable Table for planing Taper Work.

The Table can be removed for fastening work to the Apron.

It has a strong, graduated swivel vise.

Quick work, rapid changes, modern ideas

Buy the best.

IMPROVED 15-INCH PILLAR SHAPER.

The Hendey Machine Co.,

Send for Circular. **TORRINGTON, CONN.**

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Chas. Churchill & Co., Ltd., 21 Cross Street, Finsbury, London.
Schuchardt & Schutte, 59 Spandauer Strasse, Berlin.
Eugen Soller, Basel, Switzerland.

(Continued from page 22.)

S. Rosenfeld, H. De Frayne, Charles Rosenfeld, and A. I. Newman.

John Bernard Mitchell, John Watson Alexander, John Hogg Kydd, William McConnell and David Watson Alexander, with a capital of $95,000, under the title of The Bowmanville Cycle Wood Rim Company, Ltd., to manufacture and deal in wood rims and guards for cycles, are asking for a charter, the factory and chief place of business to be Bowmanville, Canada.

A project is on foot to establish a large open hearth steel plant at Duluth, Minn.; also blooming, billet and rod mills, and wire drawing and wire nail plants, connected altogether as one large plant. R. S. Munger, president of the Duluth Iron and Steel Company, is one of the promoters, representing Duluth capitalists, and S. T. Wellman representing Cleveland capitalists.

As soon as a site can be obtained, a new plant will be erected at Port Richmond, Staten Island, N. Y., by the King Drop Forge Co., which will be equipped with considerable new machinery. The capital stock of this new concern is $300,000. Mr. Lincoln King is president, W. Scott King, vice-president; A. Morris Hall, secretary, and Charles H. Ingalls, treasurer. Other directors are Chas. W. Hunt, Frank S. Gannon, William S. Van Clief, William J. Quinlan and Washington Hawes.

The Moore-Holden Machine and Foundry Company, of Fort Worth, Tex., is a new company consisting of J. F. Moore and W. Holden, who were for some years past associated with the Texas Iron and Brass Works of the same city. They will do general repair work and machine business, and are opening up on quite an extensive scale. They have purchased an outfit of tools from the Davis & Egan Machine Tool Company, and expect to be ready for operation in the course of thirty days.

January 1st, W. P. Davis moved into a new building constructed for his business. It is of brick, having a frontage of 53 feet, and a depth of 130 feet, with five well-lighted floors; it is provided with a large elevator of sufficient power to carry anything he handles, is lighted by electricity and has electric power. The building is heated by steam and has all of the modern improvements. It is located 200 feet from the N. Y. C. & W. S. R. R. tracks and five minutes' walk from the Central Depot, and is in the heart of the machinery district of Rochester, N. Y. They are building a full line of lathes from new and improved patterns, from 12 inch to 36 inch swing, and of any length of bed required, besides their usual line of drills, key-seaters and cutting-off machines. The first and second floors are used for their salesroom, the balance being used for manufacturing purposes.

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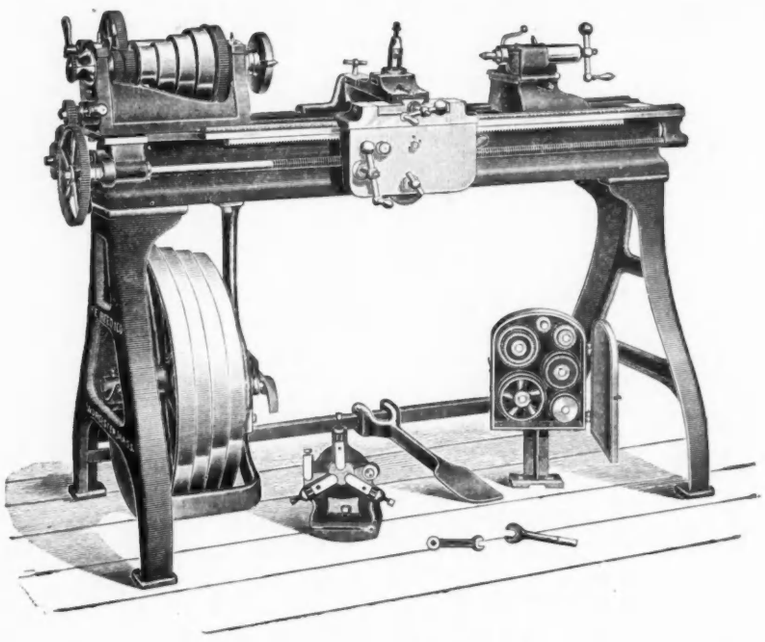

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Write us for our July Catalog.

We can save you money.

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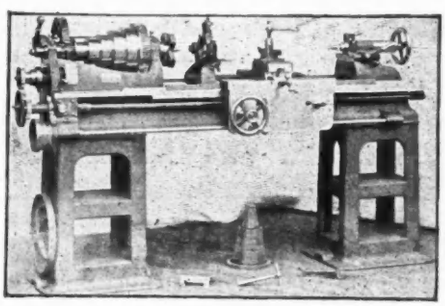

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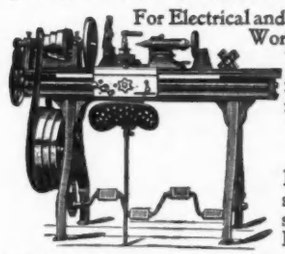

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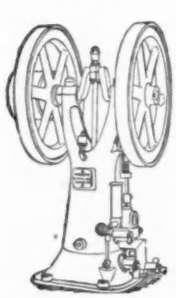

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Ingersoll-Sergeant Drill Co., New York.
Rand Drill Co., New York.

Asbestos Cement Felting.
Johns Mfg. Co., H. W., New York.

Bails, Steel.
Cleveland Machine Screw Co., Cleveland, O.

Bearings, Anti-Friction.
Ball Bearing Co., The, Boston, Mass.
Hyatt Roller Bearing Co., Newark, N. J.
Mossberg Mfg. Co., Attleboro, Mass.

Belt Dressing.
Dixon Crucible Co., Joseph, Jersey City, N. J.

Bicycle Tools.
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McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.

Blowers.
American Gas Furnace Co., New York.
Buffalo Forge Co., Buffalo, N. Y.
Cooke & Co., New York.
Roots, P. H. & F. M., Connersville, Ind.
Sturtevant Co., B. F., Boston, Mass.

Boilers, Steam.
Sterling Co., The, Chicago, Ill.
Weston Engine Co., Painted Post, N. Y.

Bolt Cutters.
Acme Machinery Co., Cleveland, O.
Davis & Egan Machine Tool Co., Cincinnati, O.
Detrick & Harvey Machine Co., Baltimore, Md.
Hill, Clarke & Co., Boston, Mass.
National Machinery Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Reece, Edw. J., Greenfield, Mass.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Strelinger & Co., Chas. A., Detroit, Mich.
Webster & Perks Tool Co., Springfield, O.
Wells Bros. & Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

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BUYERS' FINDING LIST—Continued.

Books.
Audel & Co., Theo., New York.
Baird & Co., Henry Carey, Philadelphia, Pa.
Comstock, Wm. T., New York.
Grant, Geo. B., Lexington, Mass.
Henley & Co., Norman W., New York.
Practical Publishing Co., East Orange, N. J.
Strelinger & Co., Chas. A., Detroit, Mich.
Wiley & Sons, John, New York.

Boring and Turning Mills.
Betts Machine Co., Wilmington, Del.
Bickford Drill & Tool Co., Cincinnati O.
Bullard Machine Tool Co., Bridgeport, Conn.
Davis & Egan Machine Tool Co, Cincinnati, O.
Niles Tool Works Co., Hamilton, O.
Sellers & Co., Inc., William, Philadelphia, Pa.

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Nolte Brass Co., Springfield, O.

Bushings.
New Process Raw Hide Co., Syracuse, N. Y.

Calipers.
Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Tool Co., Athol, Mass.
Starrett, L. S., Athol, Mass.
Strelinger & Co., Chas. A., Detroit, Mich.
Wilkinson & Co., A. J., Boston, Mass.

Calorimeters.
Schaffer & Budenberg, Brooklyn, N. Y.

Castings, Brass.
Lorain Foundry Co., The, Lorain, Ohio.
Nolte Brass Co., Springfield, O.

Castings, Iron.
Builders Iron Foundry, Providence, R. I.
Burr & Houston Co., Brooklyn, N. Y.
Leland & Faulconer Mfg. Co, Detroit, Mich.
Lorain Foundry Co., The, Lorain, Ohio.
Shriver & Co., T., New York.

Castings, Phosphor Bronze.
Nolte Brass Co., Springfield, O.

Castings, Steel.
Johnson Co., The, Johnstown, Pa.

Cements, Etc.—Fire-proof.
Johns Mfg. Co., H. W., New York.

Centering Drill.
Slocomb & Co., J. T., Providence, R. I.

Chucks, Drill.
Almond, T. R., Brooklyn, N. Y.
Cushman Chuck Co., Hartford, Conn.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
Morse Twist Drill & Machine Co, New Bedford, Mass.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt Chuck Co., Clayville, N. Y.
Skinner Chuck Co., New Britain, Conn.
Trump Bros. Machine Co., Wilmington, Del.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Whiton Machine Co., D. E., New London, Conn.

Chucks, Lathe.
Cushman Chuck Co., Hartford, Conn.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
National Chuck Co., New York.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Pratt Chuck Co., Clayville, N. Y.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.

Chucks, Tapping.
National Chuck Co., New York.

Clutches, Friction.
Bliss Co., E. W., Brooklyn, N. Y.
Evans Friction Cone Co., Boston, Mass.
New Haven Mfg. Co., New Haven, Conn.

Condensers.
Conover Mfg. Co, New York.
Guild & Garrison, Brooklyn, N. Y.

Counting Machines.
Durant, W. N., Milwaukee, Wis.

Couplings.
Stuart's Foundry and Machine Works, R. J., New Hamburgh, N. Y.

Coverings, Non-conducting Pipe & Boiler.
Johns Mfg Co., H. W., New York.

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Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

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Hurlbut-Rogers Mach. Co., So. Sudbury, Mass.

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Montgomery & Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Strelinger & Co., Chas. A., Detroit, Mich.
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(Continued on page 27.)

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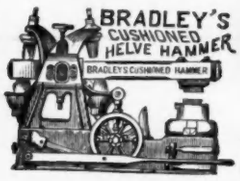

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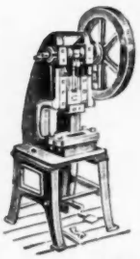

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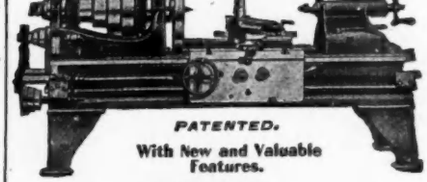

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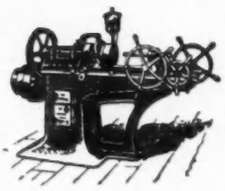

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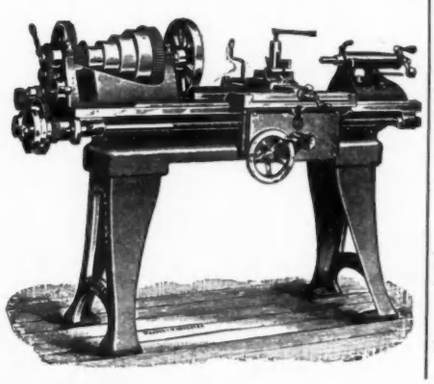

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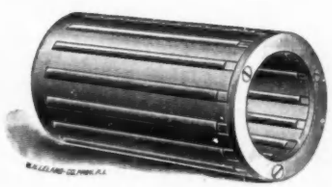

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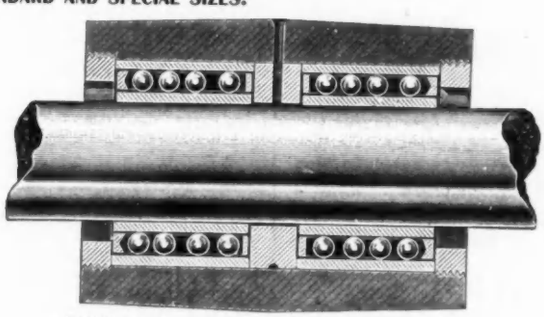

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Blaisdell & Co., P., Worcester, Mass.
Dallett & Co., Thos. H., Philadelphia, Pa.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The Cincinnati, O.
Dietz, Schumacher & Boye, Cincinnati, O.
Fitchburg Machine Works, Fitchburg, Mass.
Foote, Barker & Co. Cleveland, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Montgomery & Co., New York.
Mossberg Mfg. Co., Attleboro, Mass.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Quint, A. D., Hartford, Conn.
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Sibley & Ware, South Bend, Ind.
Strelinger & Co., Chas. A., Detroit, Mich.
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Warner & Swasey, Cleveland, O.
Wilkinson & Co., A. J., Boston, Mass.
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Wyke & Co., J., East Boston, Mass.

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Abbott, Wheelock & Co., Boston, Mass.

Drills, Twist.
Besly & Co., Chas. H., Chicago, Ill.
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Springfield Gas Engine Co., Springfield, O.
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Ames Iron Works, Oswego, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
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Frick Co., The, Waynesboro, Pa.
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Replogle Governor Works, The, Akron, O.

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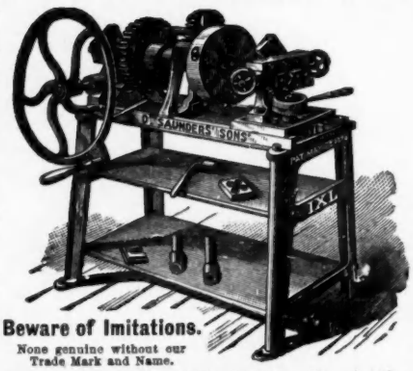

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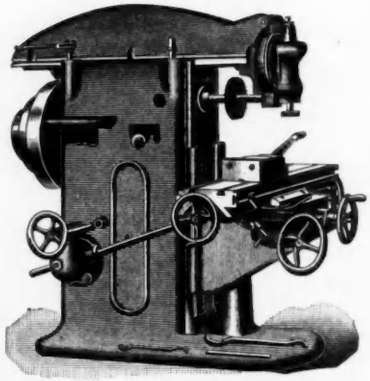

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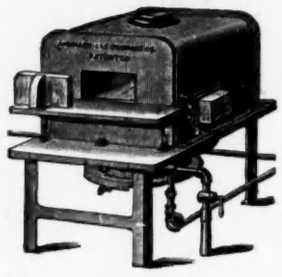

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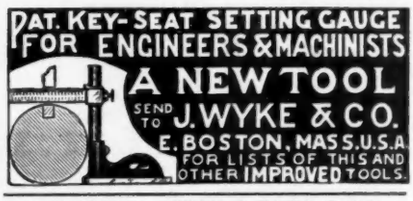

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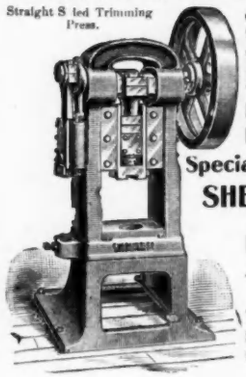

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Wiley & Russell Mtg. Co., Greenfield, Mass.

Threading Machines.
Webster & Perks Machine Tool Co., Springfield, O.

Tool Holders.
Gould & Eberhardt, Newark, N. J.

Tramways, Overhead.
Coburn Trolley Track Mfg. Co., Holyoke, Mass.

Tubing, Flexible.
Almond, T. R., Brooklyn, N. Y.

Turret Lathes (Screw Machines).
Bradford Mill Co., The, Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Cleveland Machine Screw Co., Cleveland, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Warner & Swasey, Cleveland, O.

Valves.
Consolidated Safety Valve Co., New York.
Jenkins Bros., New York.

Ventilating Fans.
Backus Water Motor Co., Newark, N. J.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant & Co., B. F., Boston, Mass.

Vises.
Bignall & Keeler Mfg. Co., Edwardsville, Ill
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
McFadden Co., Philadelphia, Pa.
Niles Tool Works Co., New York.
Place Machine Co., George, New York.
Strelinger & Co., Chas. A., Detroit, Mich.
Wyman & Gordon, Worcester, Mass.

Water Motors.
Backus Water Motor Co. Newark, N. J.
Tuerk Hydraulic Power Co., New York.

Wire Machinery.
Adt & Son, John, New Haven, Conn.
Goodyear, S. W., Waterbury, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Waterbury Machine Co., Waterbury, Conn.

Woodworking Machinery.
Barnes Co., W. F. & John, Rockford, Ill.
J. A. Fay & Egan Co., Cincinnati, O.
Pryibil, P., New York.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Wrenches.
Machinists' Supply Co., Chicago, Ill

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Here's a sample dialogue that may answer some of the questions put to us:

Q. What will our ad cost per inch per issue for a month?

A. Two dollars and forty cents.

Q. Well, how much if it runs a year?

A. Two dollars and forty cents.

Q. Why! Don't you make a discount to yearly advertisers?

A. No.

Q. Why not?

A. Because we allow advertisers to discontinue at will.

Q. Why do you do that?

A. Because we have faith in the results from our ads and do not want to make short-time advertisers pay a premium for trying our medium.

Q. Is there no way that we can get an ad in the AMERICAN MACHINIST for less than $2.40 per inch?

A. Yes. By buying space at wholesale rates.

Q. What do you mean by that?

A. Taking 500 inches within a year, at $2 per inch per issue.

Q. Suppose we take one of these contracts, use 200 inches and want to quit, can we do so?

A. To be sure. If you find you do not care to continue, you can quit by paying the regular rates ($2.40) for what you have had.

Q. One more question. While this all seems fair, there must be a reason for it. Why do you do this?

A. We want all our advertisers to get results from our paper — net results. If they do get returns, they stay in the paper and increase their space and expenditures. If their ad does not pay, we do not consider it fair to compel them to patronize us at a loss.

* * *

The question is not how much the AMERICAN MACHINIST can get out of you, but how much you can get out of the AMERICAN MACHINIST. If it helps you to more business you will give it more — we never have to worry about that.

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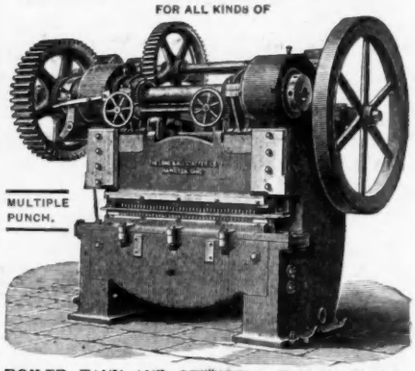

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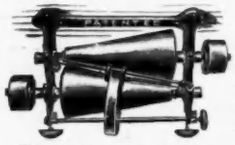
EVANS FRICTION CONE PULLEYS.



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NEW YORK BISCUIT CO., New York. 87 Sets, 5 H. P.
ALBERT MITCHELL, England. 12 Sets, 6 H. P.
C. W. BENTON, London, Eng. 33 Sets, 5 H. P.
STERLING DYEING CO., Sterling, Ct. 10 Sets, 6 H. P.
MR. S. D. WARREN, Cumberland Mills, Me. 8 Sets, 40 H. P.
WASHBURN & MORN, Worcester, Mass. A large number.
MONOTUCK MILLS, Holyoke, Mass. 1 Set, 40 H. P.; 16 Sets, 6 H. P.
MERCANTILE & CONTRACT CO., Brooklyn, N. Y. 20 Sets, 2 H. P.
MASSASOIT PAPER CO., Holyoke, Mass. 2 Sets, 40 H. P.
TRENTON IRON CO., Trenton, N. J. 9 Sets, 2 to 6 H. P.
TAUNTON COPPER CO, Taunton, Mass. 8 Sets, 2 to 6 H. P.
CLEVELAND WIRE MILLS, England. 8 Sets, 6 H. P.
STINSON BROS. & KUHLBAUM, Phila., Pa. 40 Sets, 1 H. P.
F. W. BIRD, East Walpole, Mass. 2 Sets, 40 H. P.
ARNOLD PRINT WORKS, North Adams, Mass. 10 Sets, 6 H. P.
MERRIMACK MILLS, Lowell, Mass. 18 Sets, 6 H. P.
TROY LAUNDRY MACHINE CO., Chicago, Ill. 19 Sets, 2 to 4 H. P.
RICE & CO., Lowell, Mass. 5 Sets.
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